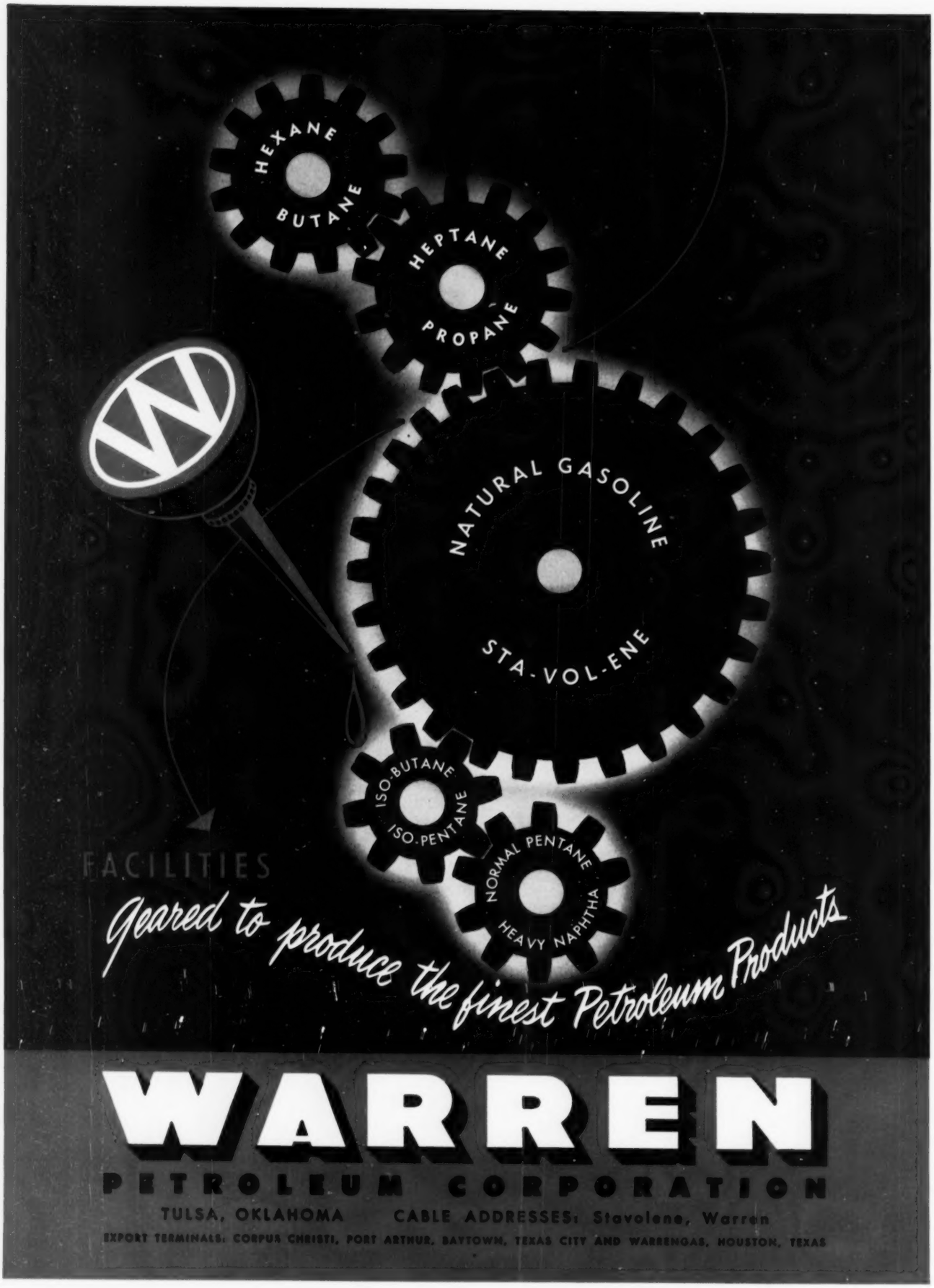
MAY 1953

World Petroleum

CANADIAN REVIEW NUMBER

one dollar
per copy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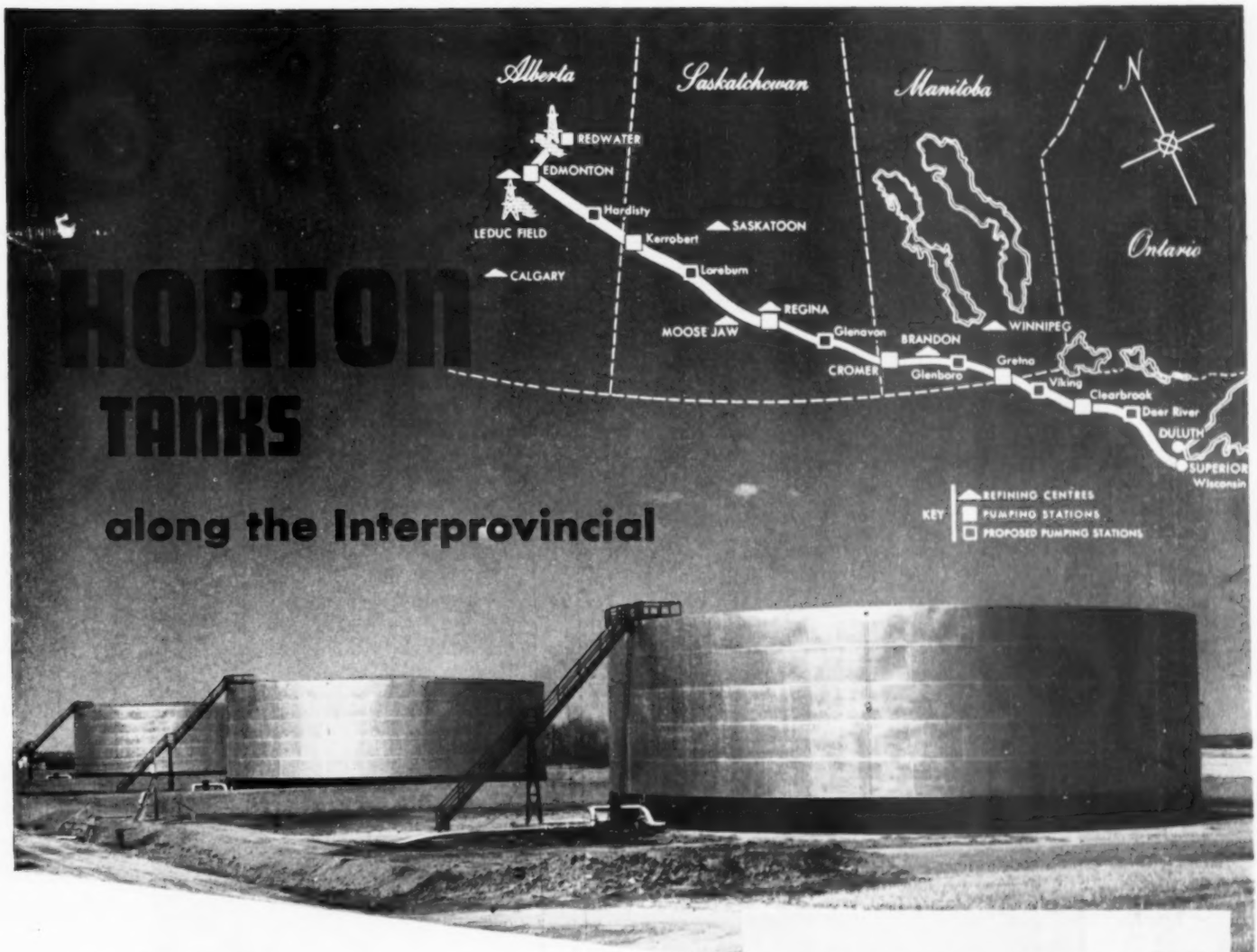
HORTON TANKS

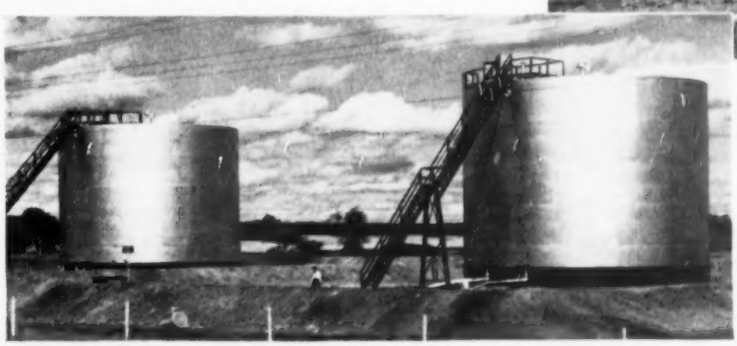
along the Interprovincial



From Edmonton, Alberta, to Superior, Wisconsin, Horton tanks are providing efficient, economical facilities for handling and storing crude transported 1,126 miles by the Interprovincial Pipe Line and its subsidiary, the Lakehead Pipe Line.

Horton Steel Works Limited builds Horton flat-bottom tanks, Hortonspheres, Hortonspheroids and other steel plate structures for Canadian locations and Chicago Bridge & Iron Company or its licensees supply similar installations for the oil industry in all other parts of the world. When planning installations, write our nearest office for estimates or quotations. There is no obligation on your part.

Visit our exhibit at the INTERNATIONAL PETROLEUM EXPOSITION Texas Bldg. BOOTHS NO. 85-86-125-126



Top: Three 140,000-bbl. Horton cone roof tanks at Edmonton, Alberta. Above: 55,000-bbl. Horton cone roof tank at the pumping station near Regina, Saskatchewan. Left: Two 13,900-bbl. Horton tanks at the pumping station near Brandon, Man.

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Long lengths save time and trouble

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McCULLOUGH
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The new McCullough Radiation Well Logger with the amazing Scintillometer (Gamma Ray and Neutron) will demonstrate its superior ability to clearly and accurately log beds of any thickness at any speed. You will be permitted to test the acute sensitivity of the new instrument with the feeble rays of your luminous dial watch. A completely equipped McCullough Radiation Well Logging Truck will be on display.

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M-3 BURRLESS BULLET PERFORATOR

The improved McCullough M-3 Burrless Bullet Perforator, the hardest shooting gun perforator in the world, features an increase of 25% in penetration over former McCullough bullet type perforators. The M-3 will outshoot any comparable size bullet or jet gun through one string of casing into soft or medium hard formation. McCullough M-3 Perforators, Burrless Bullets and actual penetration samples will be on display.

McCULLOUGH
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The only one-piece, drillable, all metal, explosion-expansion bridge plug. Drills out easily—no moving nor hardened parts to impede drilling out. Resists corrosion and electrolysis. Saves rig time in running, locating and setting. Plugs in open hole in hard formations. Assures a positive seal under the heaviest loads. Special display will permit you to weigh yourself and pressure test plug at the same time.

McCULLOUGH
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Be sure to see these remarkable tools. The Magna-Tector measures both stretch and torque in stuck pipe, locates lowest free point. The McCullough String Shot loosens first joint above the free point. Combines all the advantages of both the Magna-Tector and String Shot into a single service with one set-up. Many remarkable jobs have been accomplished at great savings to the operator.

McCULLOUGH
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The complete line of all other McCullough Electric Wire Line and certain Fishing Tools will also be on display, including the McCullough Bottom Hole Jet Cutter, Jet Casing Cutter and Double Acting Rotary Jars—tools that have been used with outstanding success in every active oil field in the world. Qualified McCullough representatives will demonstrate the amazing abilities of all McCullough Tools.

LOCATION—BOOTHS 22-23-24. Use Entrance No. 2 from Twenty-First Street (the main street to the show from Tulsa) at the southeast end of the show grounds. McCullough booths are to the right of the entrance, opposite Old Timers Headquarters.

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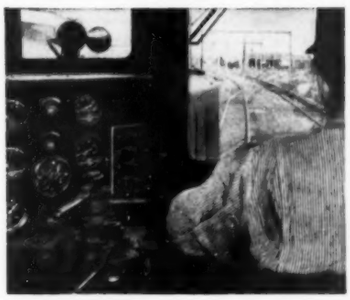
You can expect availability to the job of 8000 hours out of an 8760-hour year from the G-E industrial locomotive on your in-plant switching operation. This peak availability, plus nearly one-third savings in operating costs, can boost your switching productivity and cut costs from the very first day of operation.

High maximum speeds and tractive effort allow G-E switchers to move quickly from job to job, start big loads, spot cars smoothly and accurately. Switching time can be cut as much as 50% over old or obsolete motive power. Diesel-electrics operate for long periods between overhauls, require only periodic inspection and maintenance.



Easy to Operate Finger-tip control, wide visibility (above) and easy operation help reduce damage, cut operator fatigue. Responsive electric drive makes reversing quick and simple. Diesel-electrics start quickly with no time lost in warming up.

Save Manpower G-E diesel-electrics need only one man for operation, do not require special maintenance or servicing crews. Refueling (above) and oiling can be done quickly between job calls. Service and maintenance points are readily accessible.

More Work per Switcher You need fewer switchers for the job with G-E diesel-electrics. In many applications, G-E switchers have replaced steamers one for two with proportionate operational savings. Tough, sturdy construction means long, useful life.

Your G-E representative can show you how G-E switchers bring productivity and savings to new peaks. See him for every haulage need.

For Bulletin GEA-4909B, write to International General Electric Co., Apparatus Sales, 570 Lexington Ave., New York 22, N. Y., U. S. A.

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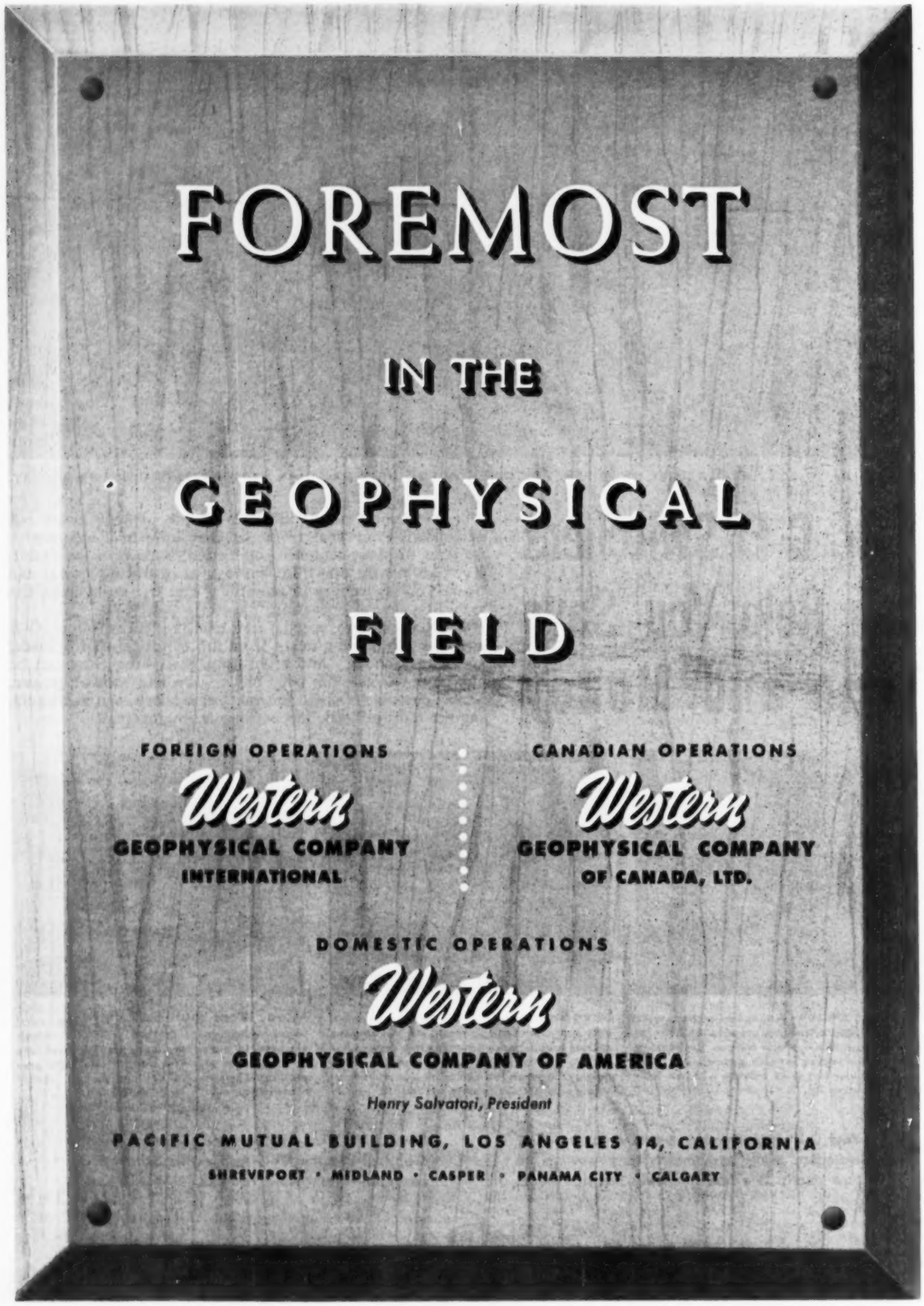
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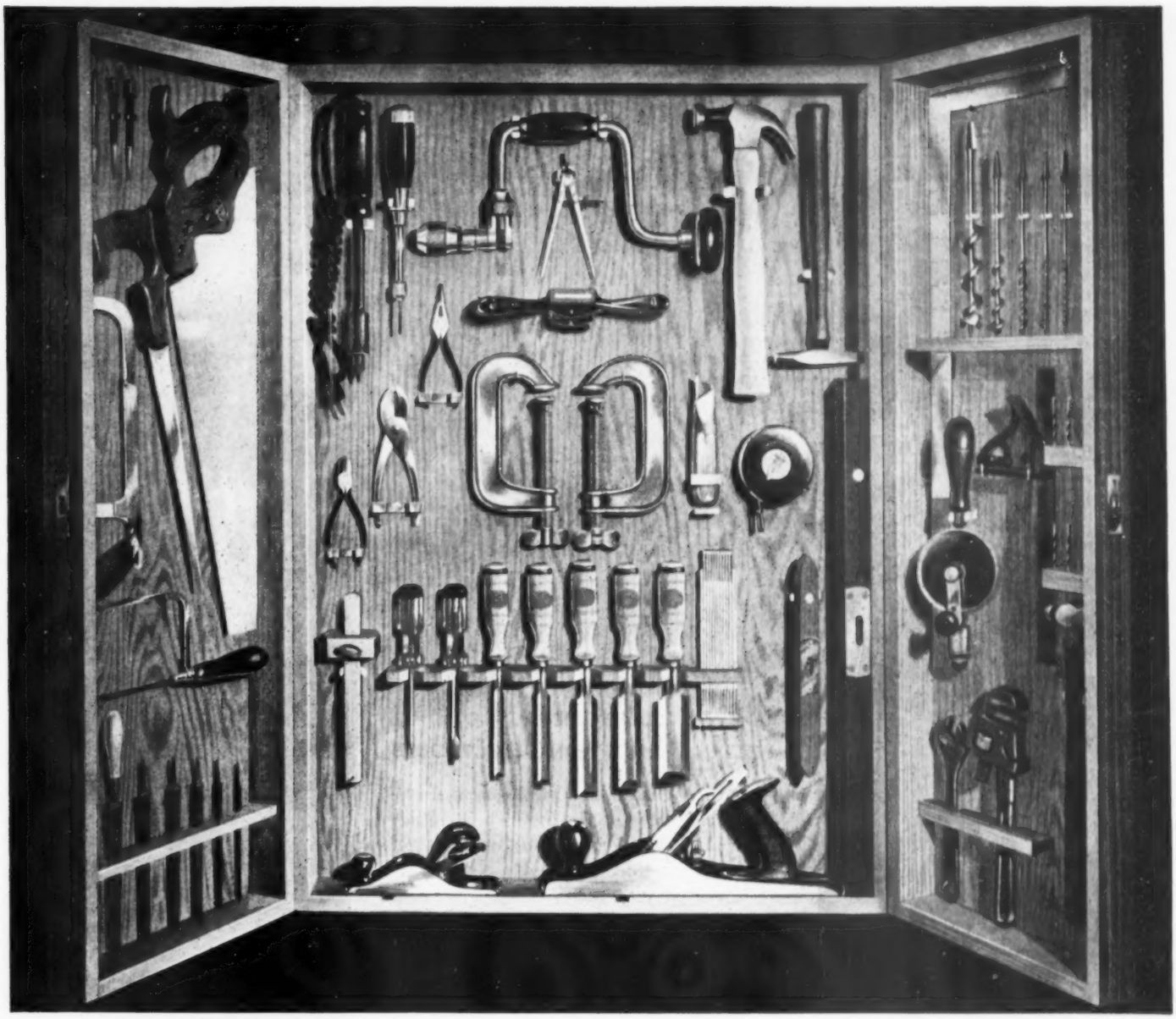

A tool chest for Canadian refiners

You can see at a glance that this handsome chest contains about everything you need to do a good job.

It isn't quite so easy to picture the many "tools" in the Ethyl Antiknock, Limited, service chest, however. But it has everything you need, too.

For example, take Ethyl's precision engineering tools—technical services, road testing, gasoline testing, blending, and a broad safety program—all designed to help Canadian refiners produce high quality regular and premium fuels.

Then add Ethyl's sales tools—such as dealer-education booklets, films, and the Product Sales Clinic which more than 20,000 Canadian dealers, salesmen, and marketing men will have seen by the end of this year. Also Ethyl's fleet program for the bus and truck field, and the farm program to help Canadian refiners sell more gasoline and lubricants for tractors.

What makes all these Ethyl service tools particularly valuable is that they are in the hands of experienced men. Ethyl Antiknock, Limited, has access to a vast fund of antiknock data developed over the last thirty years . . . and it is our intention to make all of it available to our customers.

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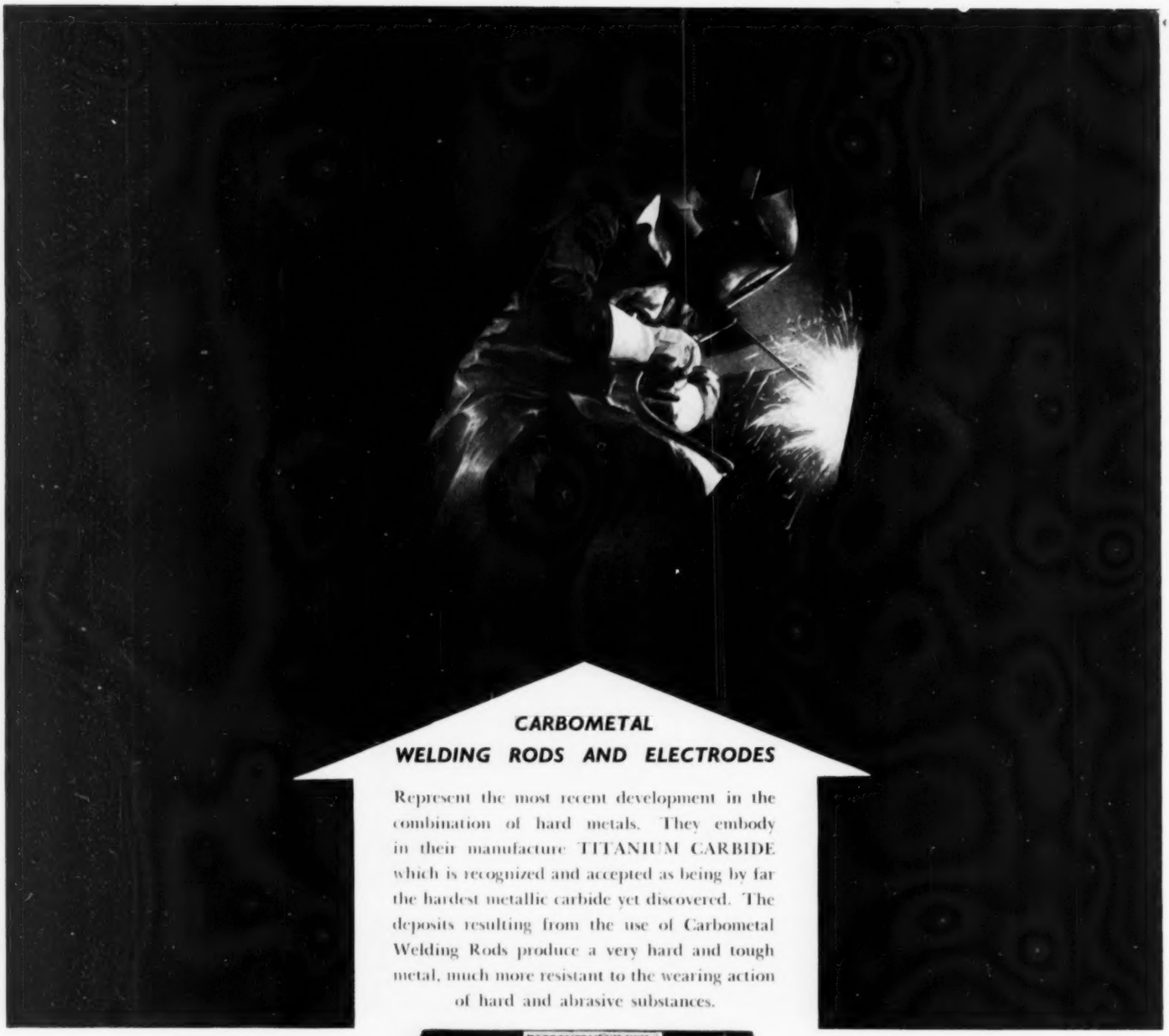

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Represent the most recent development in the combination of hard metals. They embody in their manufacture TITANIUM CARBIDE which is recognized and accepted as being by far the hardest metallic carbide yet discovered. The deposits resulting from the use of Carbometal Welding Rods produce a very hard and tough metal, much more resistant to the wearing action of hard and abrasive substances.

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You bought a lot of horsepower when you got that modern car.

Now you can *seal in* all that power . . . with the famous VEEDOL "Film of Protection."

VEEDOL Motor Oil *seals in* horsepower by resisting blow-by! It contains detergent additives that suspend contaminants, leaving your engine cleaner after draining. And it combats the metal-eating action of "engine sweat" by forming the famous anti-corrosion "Film of Protection" on metal surfaces.

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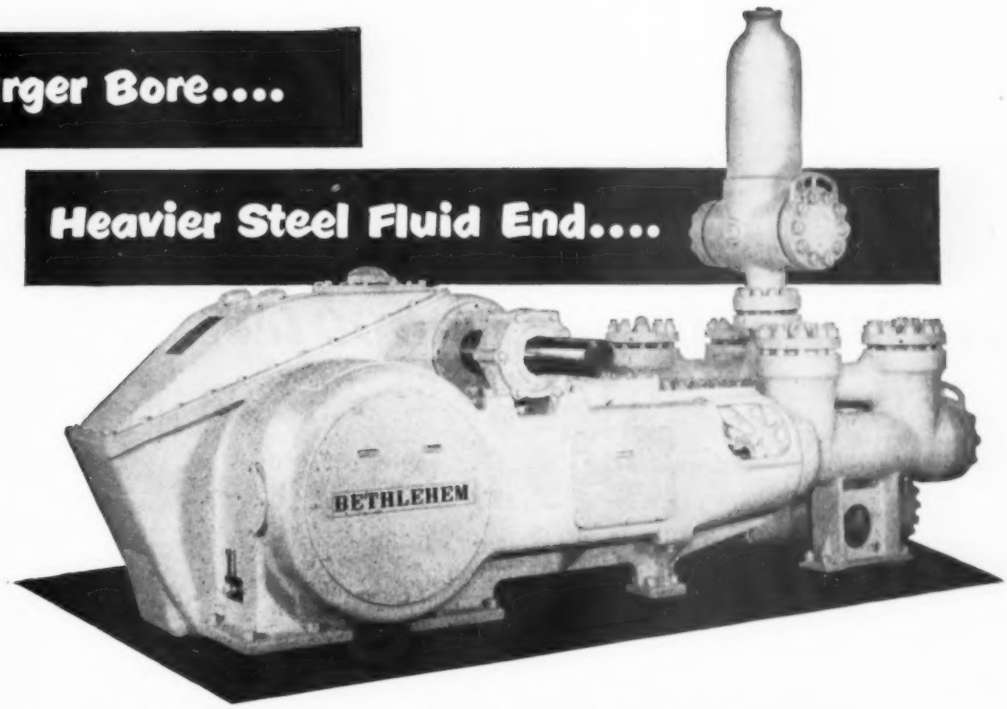
Heavier Steel Fluid End....



in Bethlehem Slush Pumps

Now, in all the four top sizes of Bethlehem slush pumps, you get a larger bore to accommodate an 8-in. liner. This means greater volume, of course. And all four sizes are equipped with heavy, massive fluid ends to withstand the pressures of modern drilling. It's a Bethlehem *plus* – extra volume at those extra-high pressures.

These pumps are mighty rugged. Even the 225, smallest of the group, is a powerhouse. And the 600, head man of the lot, is the biggest, strongest unit Bethlehem has ever offered.

There are many features common to all – features that add to the smoothness, long life, and overall efficiency of the pumps. For example: complete oilbath lubrication (trouble-free!). And roller bearings throughout. And such important details as API metal ring gaskets on valve covers, suction flanges, discharge flanges, stuffing boxes.

We can't possibly tell you the full story in this small space. But any time you say, a Bethlehem engineer will be glad to go over the units with you, point by point. There's a Bethlehem pump for every drilling job you have. Write for information; complete details will be sent promptly.

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225	8 in. x 14 in.
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450	8 in. x 16 in.
600	8 in. x 18 in.

A complete line for depths ranging from 3500 ft. to maximum.

Bethlehem also manufactures a complete line of drawworks, crown and traveling blocks, swivels, and rotary tables; and, for production work, pumping units in a wide range of sizes and types. Write for full information.

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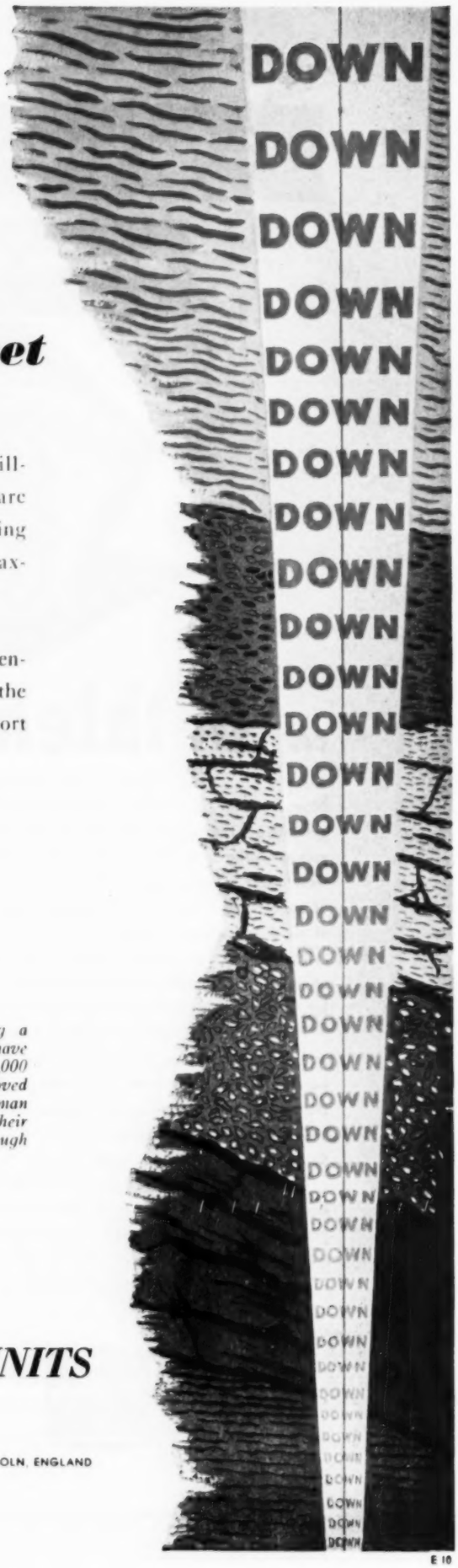
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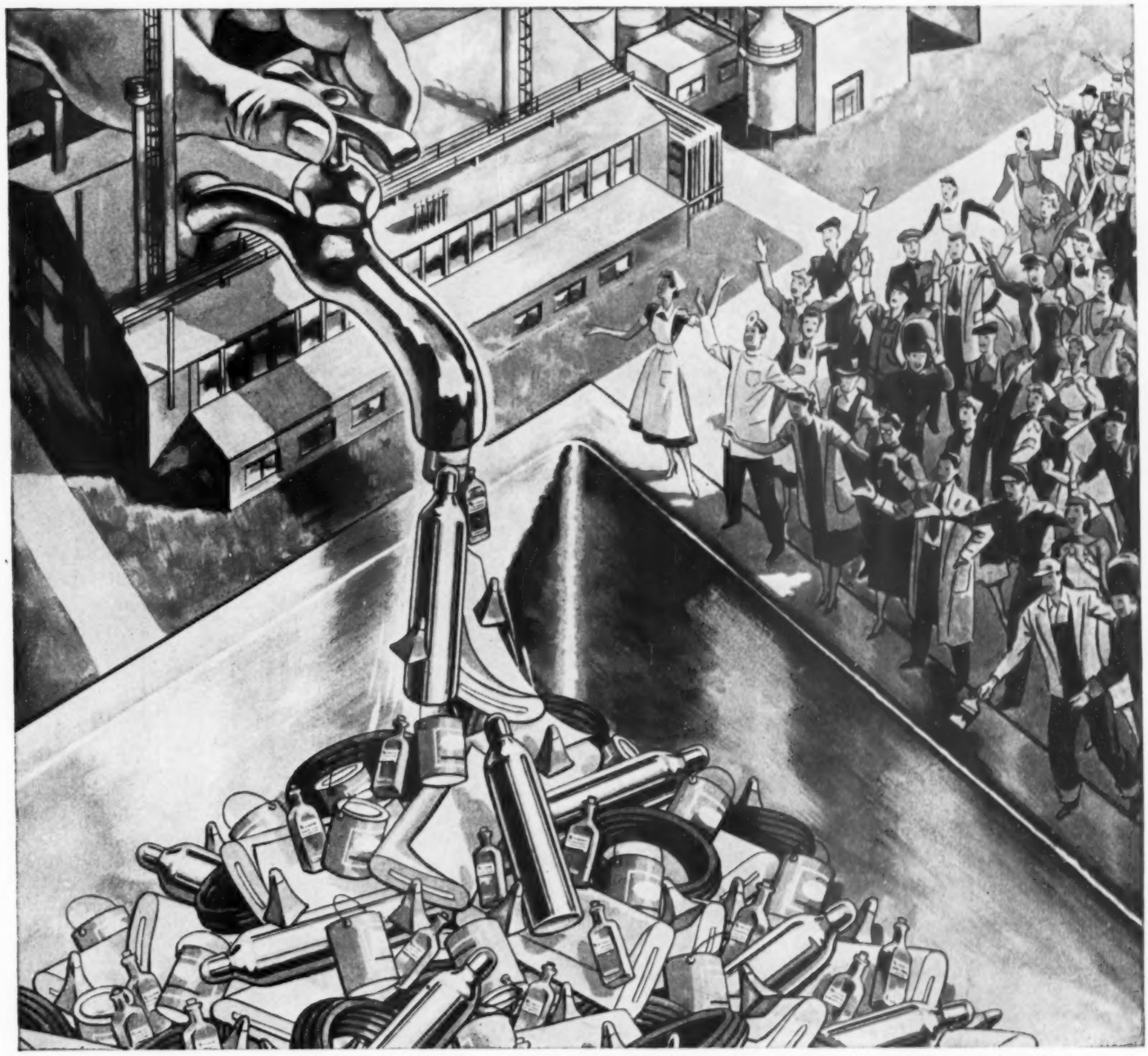

First Canadian producer of both Acetone and Isopropyl Alcohol, Shell Oil Company's new Montreal Petrochemical Plant is now "on stream."

Reveille for Giant Taps

As the "taps" open up, and the newly built Shell Petrochemical Plant in Montreal goes "on stream," Canadian Industry can look forward for the first time to filling its needs with an all-Canadian supply of both Acetone and Isopropyl Alcohol.

To foresee and fulfil the needs of Canadian Industry is the constant purpose of the Chemical Division of Shell Oil Company of Canada, Limited. Their success in this respect is amply illustrated by the opening of this new Petrochemical Plant in Montreal, and the many other "firsts" they have achieved in Canada during the past.

Chemical Division

SHELL OIL COMPANY OF CANADA, LIMITED

Chemical Partner of Industry and Agriculture

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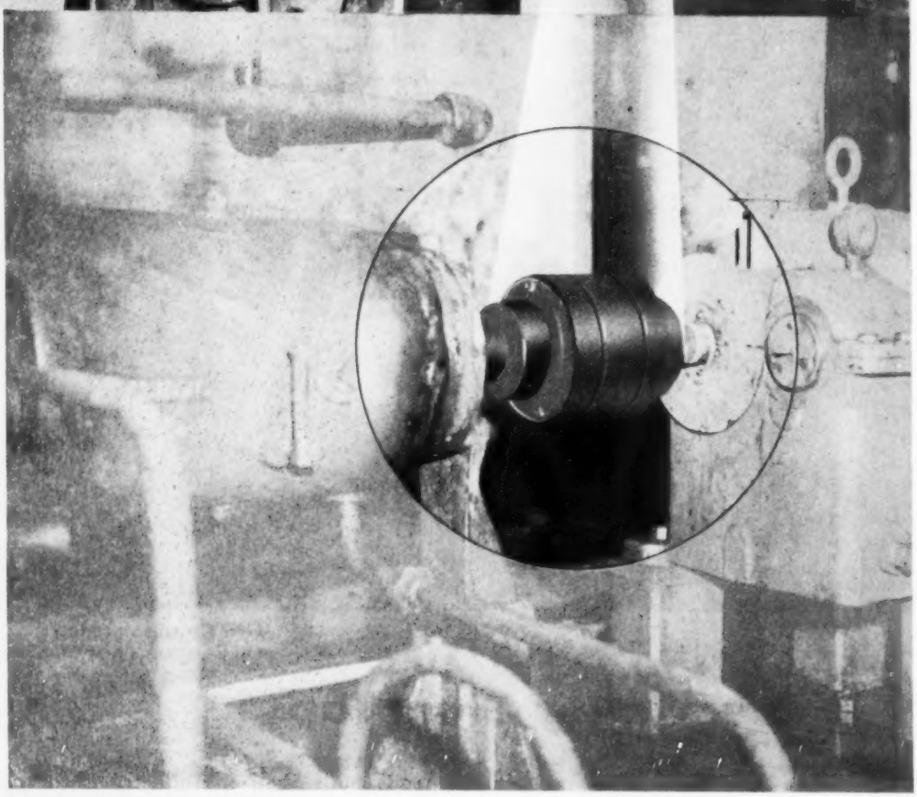
At last a coupling which provides true flexibility without the need for any lubrication whatsoever. The photograph shows an M77 spacer coupling fitted to a 200 h.p. turbine driven slurry pump at the great Esso Refinery, Fawley. The operating temperature in this case is 700° Fah. An extensive range of both spacer and non-spacer type couplings to suit every condition and duty is available.

Photograph published by kind permission of the Esso Petroleum Company Ltd.



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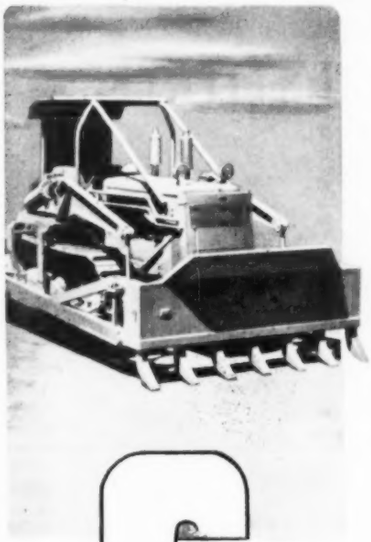
We wish to record our appreciation and thanks to the engineers and staff at the ESSO PETROLEUM COMPANY'S FAWLEY REFINERY, where during extended tests, we have received help, advice and constructive criticism at all times, resulting in the development of the METASTREAM PATENT FLEXIBLE METALLIC COUPLING



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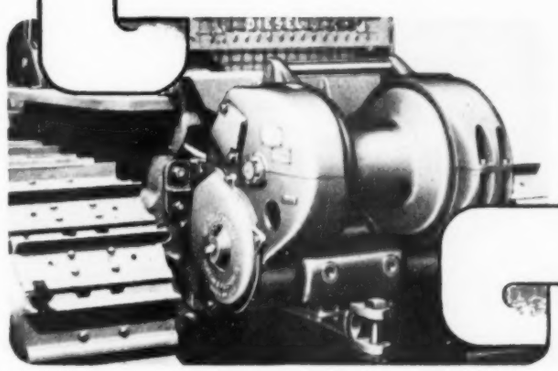
Here is allied equipment accurately designed and perfectly matched to work with International Crawler Tractors and Engines. Use this modern way to put more power and more speed into moving dirt.

For all facts on International Power and the equipment that works with it, see your International Distributor. What's more, he has service and maintenance facilities to back it up.



Shown are some of the outstanding allied equipment lines: Pullman-Standard Klearing-Blade with TD-18A tractor, Drott Skid-Shovel and TD-9 tractor, Carco Winch on TD-18A tractor, Bucyrus-Erie Bullgrader with TD-24 tractor, Hough Payloader.

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We are licensees in Great Britain for the manufacture of Reference Master and Working Gauges to all A.P.I. Specifications, and in all sizes from the small Gauges used on pump fittings up to 20" dia. Gauges for Line Pipe Casing, including the fast taper Gauges for the Rotary Drilling Equipment, some of which are shown in the above illustration.

All A.P.I. Reference Master Gauges made by us are checked and certified by the National Physical Laboratory, or National Bureau of Standards U.S.A. for Tool Joint Threads, who issue a certificate showing the sizes of the Gauges, together with the "Stand-Off" (S) value for the mating Plug and Ring.

We shall be pleased to quote for Gauges to meet your requirements and also give you the benefit of our technical experience with regard to their use and maintenance.

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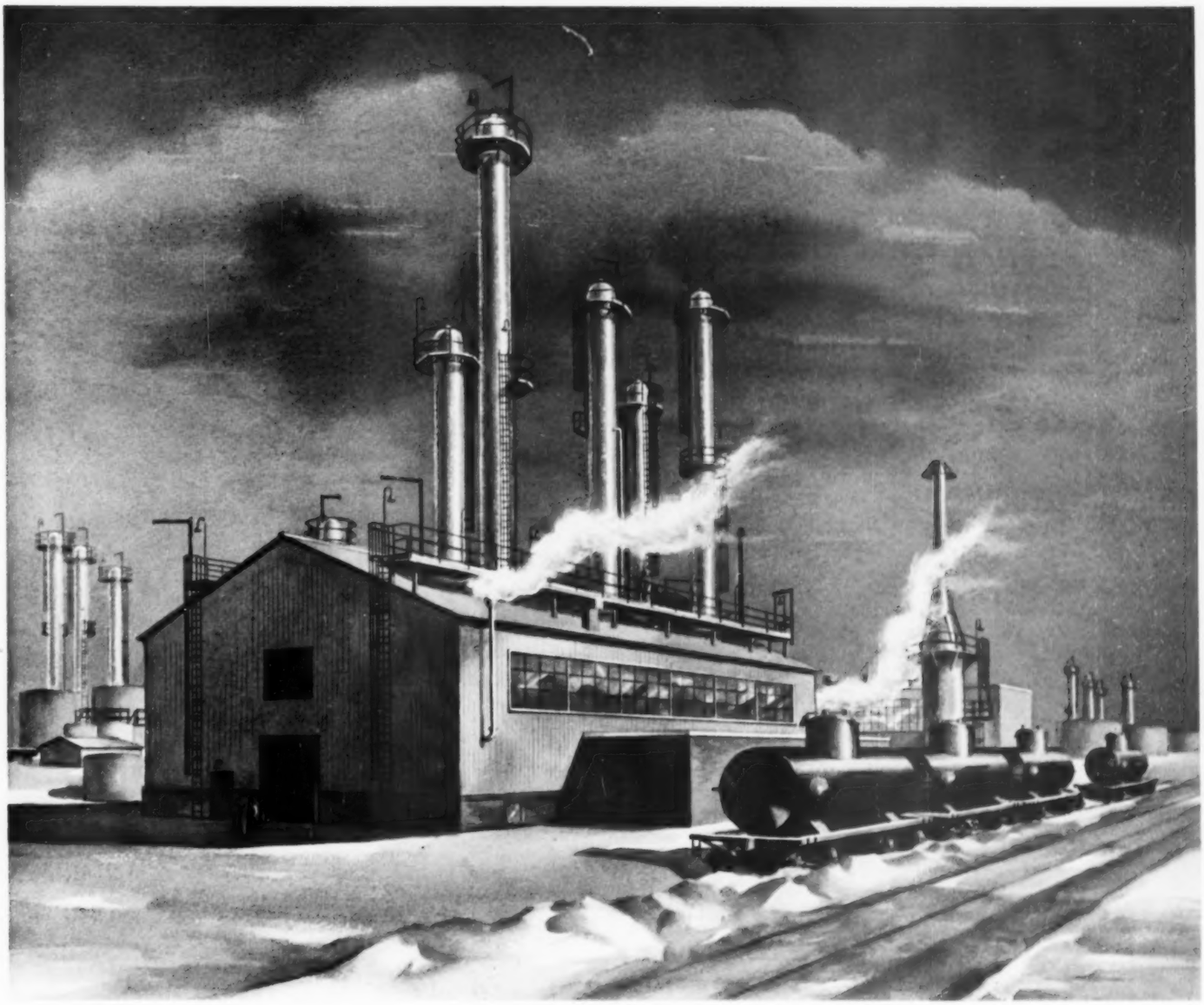

Chemicals from Canada's Petroleum

This new chemical plant at Montreal, was recently put into operation by the Shell Oil Company of Canada, Ltd. The manufacture of isopropyl alcohol and acetone is another important milestone in the growth of Canada's chemical industry.

The plant itself is typical of the complete research, engineering, and construction services rendered by Braun to broadly diversified processing industries.

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Oil helps him dig deep treasure...ore!

Each year, America's miners send up from below ground over 79 million tons of ore. The metal from this ore makes a million things — from bathtubs to battleships. Things that help us live better, things that help make our country strong.

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*

Awards This Year	Years of Experience
11	More than 20
34	More Than 15
26	More Than 10
123	More Than 5
Total 194	More Than 2200

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In catalytic

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the

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That's why

you should know the story

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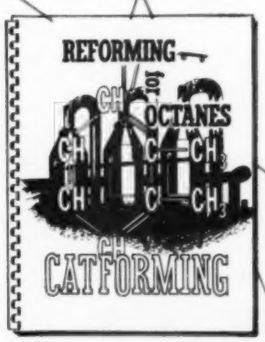
CATFORMING

THAT COUNTS

Many years have gone by since catalytic reforming was first utilized by the petroleum industry. As with many developments, earlier methods fell far short of ideal.

Many years ago Atlantic's engineers and chemists looked well ahead to the more demanding needs of industry-wide commercial application. They devoted themselves to continuous and unrelenting laboratory research. One catalyst after another was rejected for failing to meet Atlantic's projected ideal catalyst. Finally, a catalyst possessing new characteristics and demonstrating an ability to surmount the shortcomings of previously developed catalysts was found. This completely new catalyst, combining the advantages of improved selectivity, greater stability, excellent resistance to poisoning, and easier regeneration, is the heart of CATFORMING.

CATFORMING is now in successful commercial operation, furnishing positive proof that IT'S THE CATALYST THAT COUNTS. You are invited to share the many benefits of CATFORMING by joining our ever-growing list of licensees. Call or write for our new detailed bulletin for your introduction to CATFORMING. The Atlantic Refining Company, Research and Development Department, P. O. Box 8138, Philadelphia 1, Pa. (Telephone, Howard 5-2345.)



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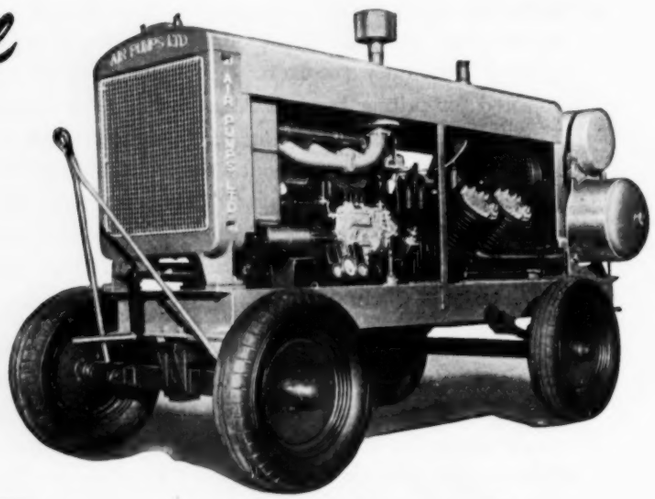

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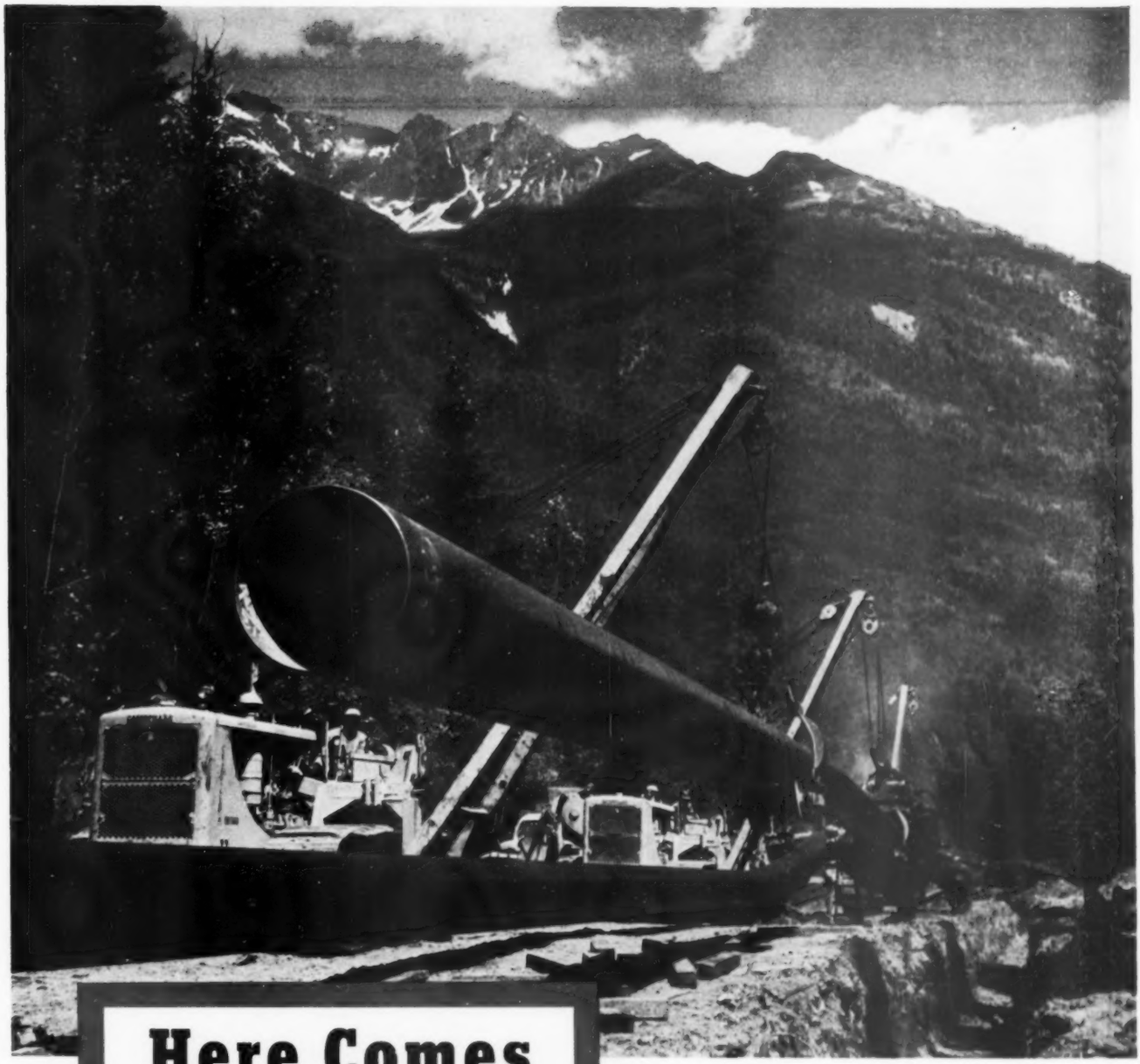

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TRANS MOUNTAIN OIL PIPE LINE
is well ahead of schedule—welcome news on both sides of the border.

For this big trunk line, pioneering from Alberta to the coast, ushers in an entirely new era in Pacific Northwest oil economics. Assurance of a plentiful supply under all conditions—and at low transportation costs—makes the opportunity for industrial development more attractive than ever in the fast-growing evergreen empire.

The Bechtel organization is responsible for design and construction of the pipe line and of two refinery projects it will feed, located near Vancouver and Seattle respectively.

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This organisation has made a special study of steel requirements of the petroleum industry: plates for fusion welded vessels; constructional steel; forgings; alloy steels, including corrosion and heat-resisting types; etc. The Technical Departments will be pleased to discuss specific applications with manufacturers of petroleum equipment.

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24 ACRES *Cover the World*

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DROP FORGED STEEL

VALVES, FITTINGS and FLANGES

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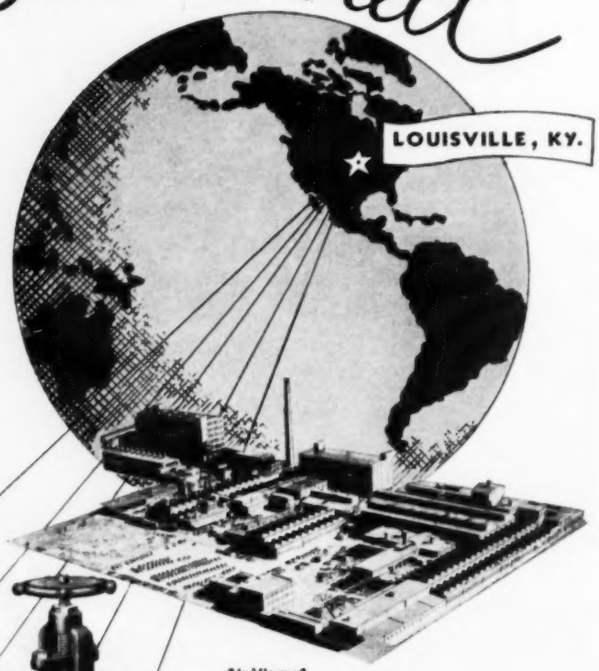

Air View of
Henry Vogt Machine Co.

This 24 acre Vogt plant supplies the most comprehensive line of top quality *drop forged* steel piping materials anywhere available to industry. That's why they're the choice of leading refineries, power plants, chemical plants, etc., the world around!

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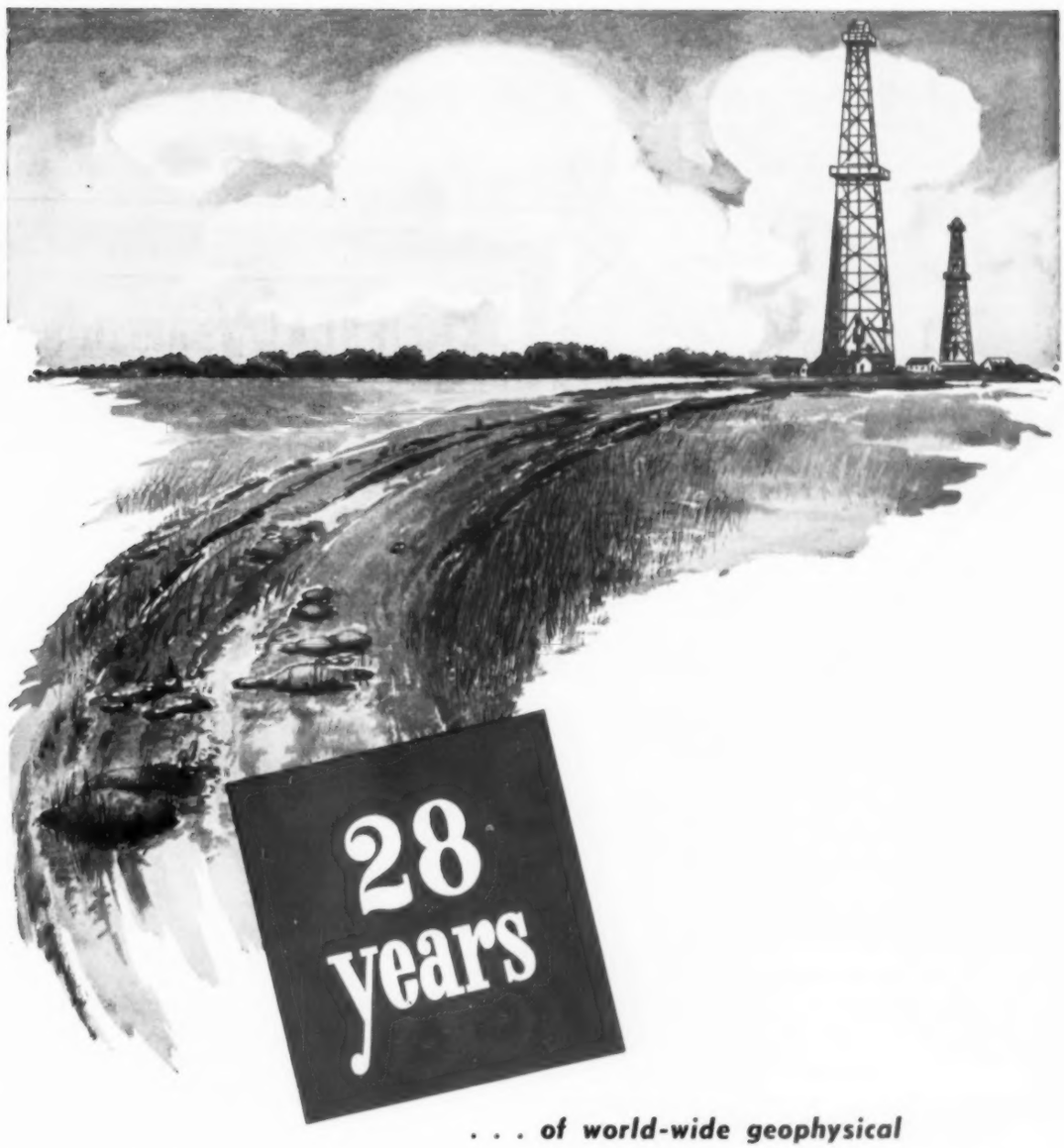

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PLANS FOR DOUBLING THE PLANT CAPACITY IN THE NEAR FUTURE ARE WELL IN HAND

How to get the most for your tube steel dollar: Ask the experts!

This month the Timken Company reports on:

18-8 STAINLESS

An austenitic, non-magnetic alloy that shows the best combination of creep strength, oil corrosion resistance and oxidation resistance for service up to 1500°F. For use in oil cracking systems, hydrogenation equipment, high temperature oil and steam piping, superheater elements, heat exchangers.

ONE OF 24 TIMKEN HIGH TEMPERATURE STEELS

Carbon	Sicromo 2	Sicromo 5S	18-8 Ti
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	16-13-3
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-20*
Silmo	Sicromo 3	Sicromo 9M	25-12*
DM	4-6% Cr.-Mo.	18-8 Stainless	35-15**
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	16-25-6**

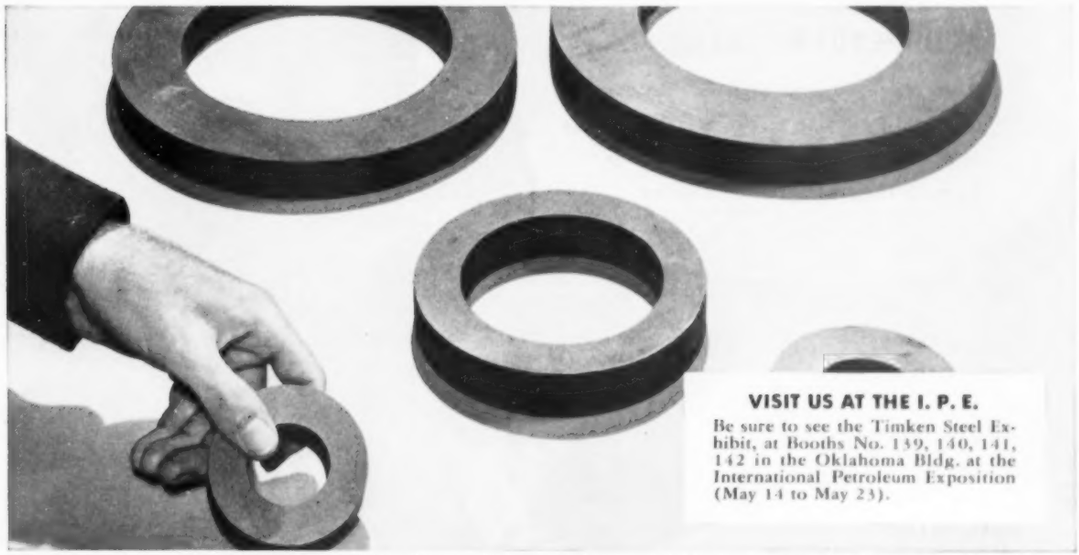
** Available as seamless tubing on an experimental basis only.*
***Not available as seamless tubing.*

ALTHOUGH several high temperature steels may be the answer to your heat, pressure, corrosion and oxidation problems, there's only one analysis that will give you maximum tube life per dollar spent—the best life/cost ratio.

To find it, *ask the experts!*

The Timken Company's metallurgists — recognized authorities on high temperature steels, with over 20 years of steel research and experience—will help you select from 24 different analyses, the one steel that will give you the most for your money. And no matter which analysis you select, you'll be sure of uniform quality because the Timken Company rigidly controls quality from melt shop through final inspection.

Let Timken's "RSQ"—Research, Supply, Quality—solve your tube problems. *Ask the experts!* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".



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Be sure to see the Timken Steel Exhibit, at Booths No. 139, 140, 141, 142 in the Oklahoma Bldg. at the International Petroleum Exposition (May 14 to May 23).

Typical examples of Timken heavy-wall pressure tubing—available in sizes up to 10 1/2" O.D.

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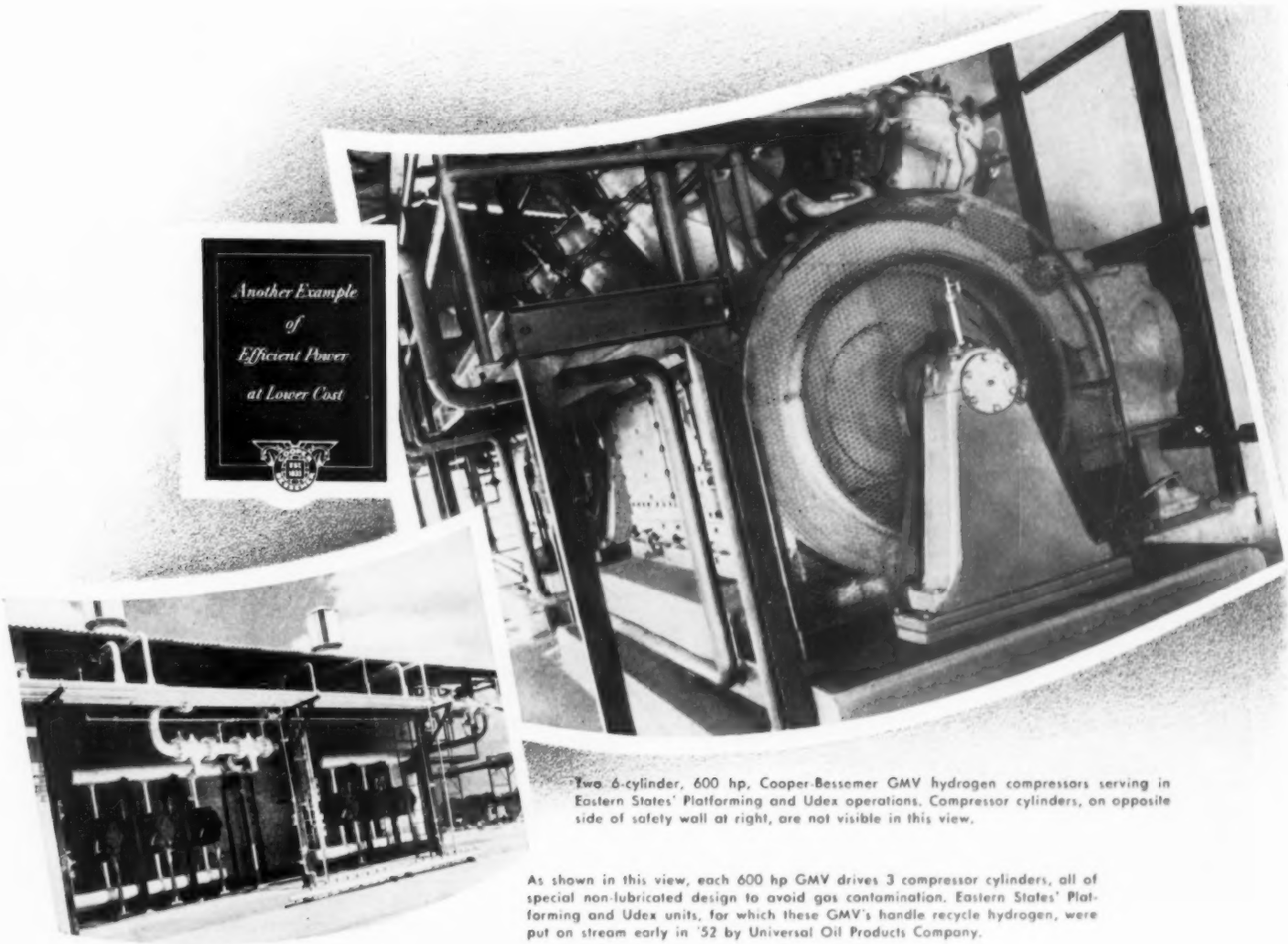

Two 6-cylinder, 600 hp, Cooper-Bessemer GMV hydrogen compressors serving in Eastern States' Platforming and Udex operations. Compressor cylinders, on opposite side of safety wall at right, are not visible in this view.

As shown in this view, each 600 hp GMV drives 3 compressor cylinders, all of special non-lubricated design to avoid gas contamination. Eastern States' Platforming and Udex units, for which these GMV's handle recycle hydrogen, were put on stream early in '52 by Universal Oil Products Company.

THEY LICKED A TOUGH PROBLEM
in Eastern States' Platforming Unit with Cooper-Bessemer GMV's

THE two GMV's shown here operate as recycle hydrogen compressors for the remarkable new Platforming and Udex units in the Houston refinery of Eastern States Petroleum Company, Inc.

In this processing it was particularly important to avoid contamination of the recycle gas. To solve this problem, Cooper-Bessemer successfully developed ***non-lubricated compressor cylinders*** with light carbon pistons and segmented carbon rings. Moreover, cylinder bores were honed to a mirror finish of 4 to 6 micro inches. Now, after thousands of hours of operation, checks show no excessive wear anywhere.

If you have a similar problem, or compressor requirements of virtually *any* type, you'll find Cooper-Bessemer ready to cooperate . . . as usual . . . all the way.

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The Cooper-Bessemer Corporation

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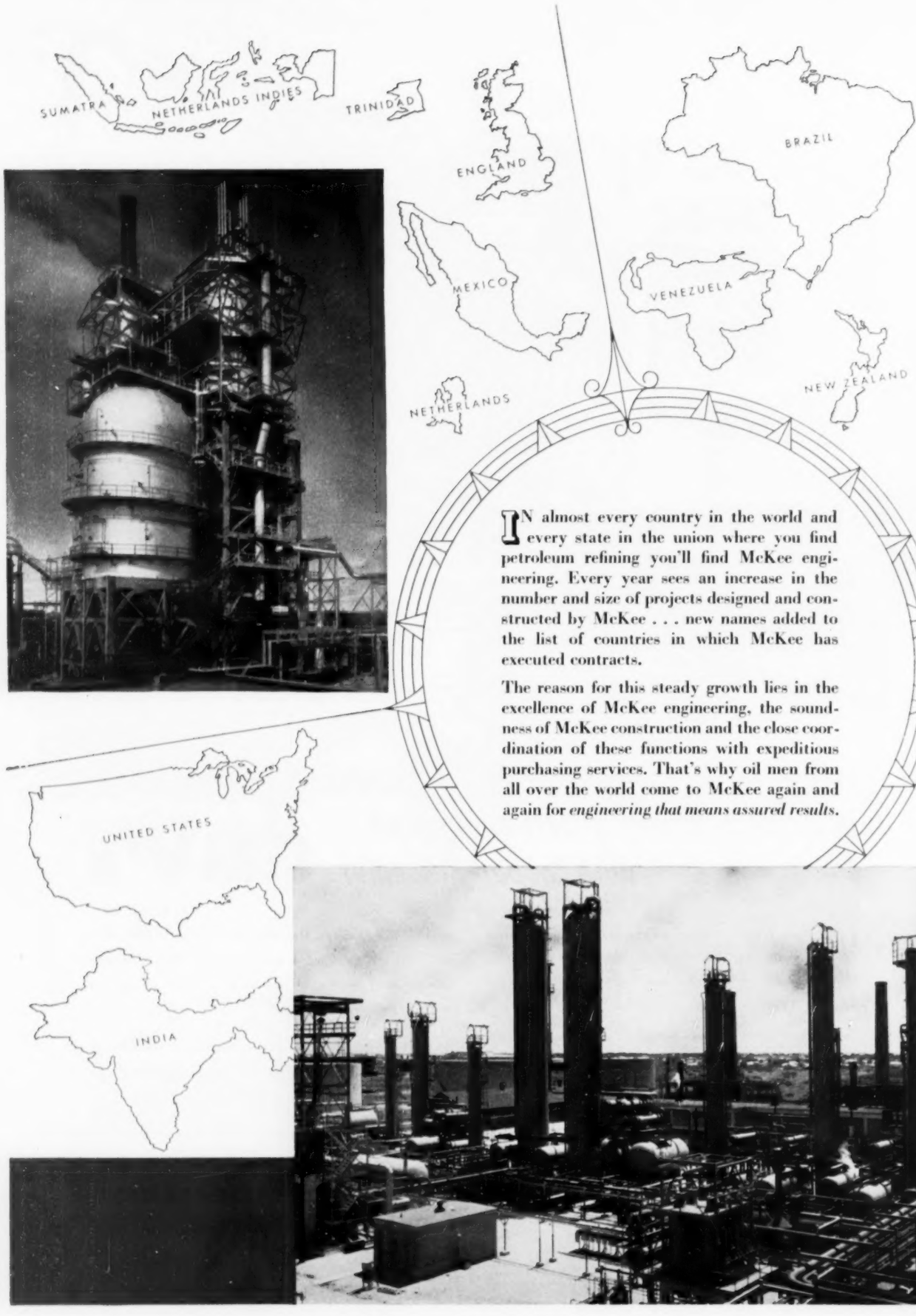
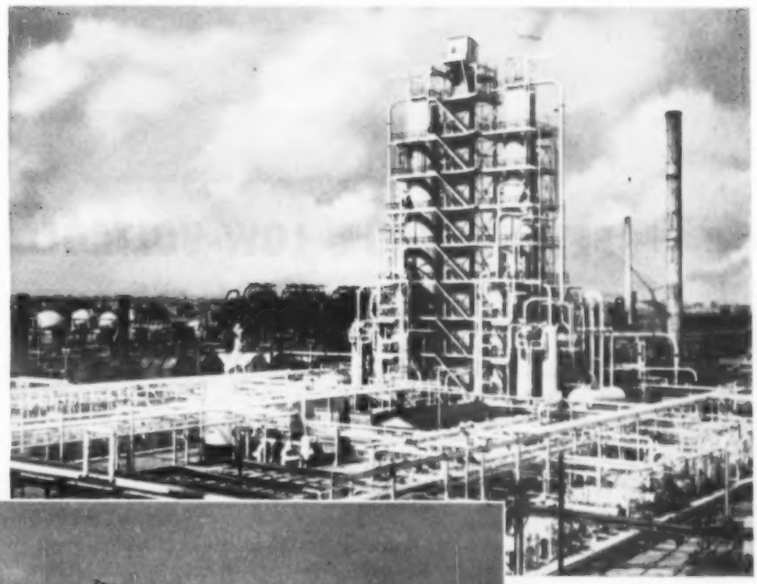
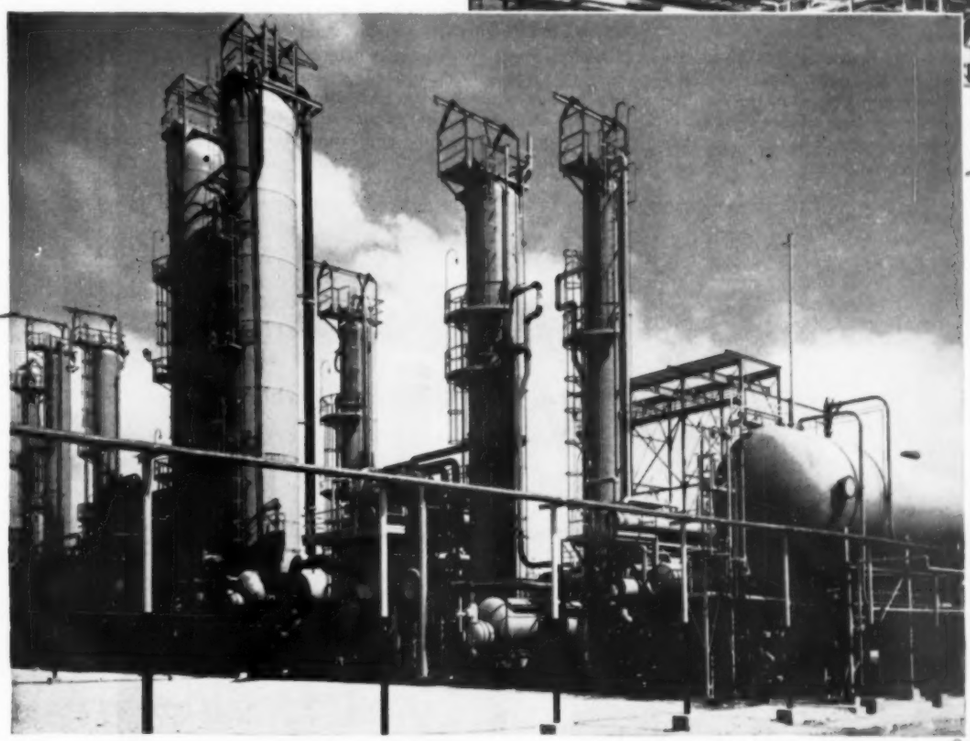


IN almost every country in the world and every state in the union where you find petroleum refining you'll find McKee engineering. Every year sees an increase in the number and size of projects designed and constructed by McKee . . . new names added to the list of countries in which McKee has executed contracts.

The reason for this steady growth lies in the excellence of McKee engineering, the soundness of McKee construction and the close coordination of these functions with expeditious purchasing services. That's why oil men from all over the world come to McKee again and again for *engineering that means assured results*.





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SET UP YOUR LOW-VOLTAGE SWITCHGEAR

from 10 basic units!

Remarkable flexibility is an outstanding advantage of Westinghouse "Unitized" Low-Voltage Switchgear.

"Unitized" design lets you plan your own switchgear set-up from 10 basic units . . . equipment can be arranged to meet any requirements for generator, incoming-line and feeder control up to 600 volts.

"Unitized" design virtually eliminates special design and engineering costs. Yet it meets specific application needs dictated by the number and ratings of circuits and offers a wide selection of instruments, relays and circuit-breaker attachments.

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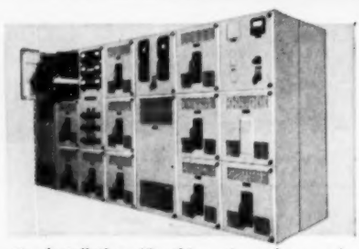
Westinghouse low-voltage switchgear for indoor or outdoor installations is designed for interrupting capacities from 15,000 amperes to 100,000 amperes, in continuous ratings from 15 to 6,000 amperes, for any ratings up to 600 volts.



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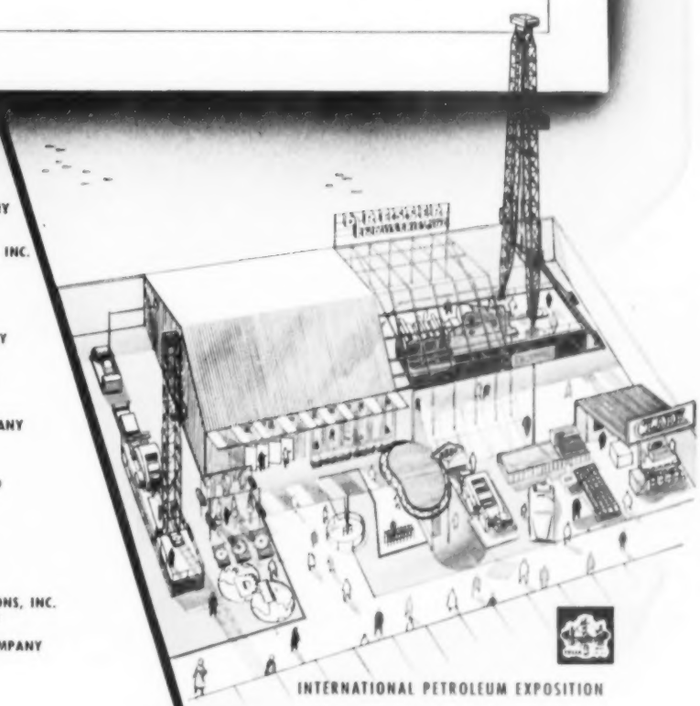

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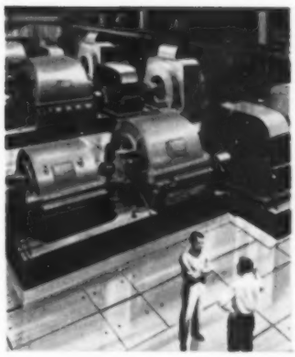

Roots-Connersville Blower Division, ***Connersville, Ind.*** Rotary positive blowers, gas pumps; centrifugal blowers, exhausters; positive displacement meters.

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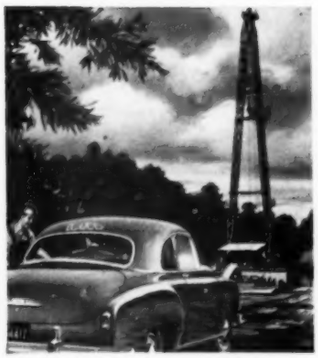
Clark Bros. Co. Division, ***Olean, New York.*** Engines and compressors — gas, steam and diesel driven.



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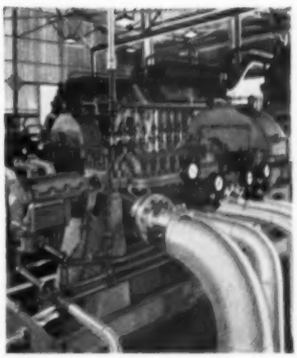
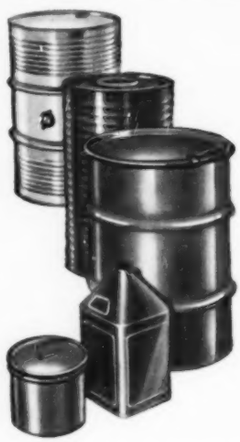


Dresser Manufacturing Division, ***Bradford, Pa.*** Oil and gas and pipe couplings, fittings and sleeves — rolled and welded rings — welding fittings and flanges.

Stand and deliver!

The highwayman of the eighteenth and early nineteenth century, much romanticised in fiction, was in reality little more than a thug. His cry of "Stand and deliver!" was dreaded by timorous travellers, as the prelude to ruthless highway robbery. These bandits added yet another peril to travel by stagecoach — a form of transport which already presented hazards enough!

Today's transport has its hazards, too . . . Bandits may be fewer and farther between, but whenever valuable goods must be transported over long journeys, no precautions may be neglected to prevent losses in transit. Not the least of these precautions—perhaps the most important—is safe packaging. Valuable fluids, powders or kindred products need to be packed in foolproof containers that will withstand, without leakage, the hurly-burly of rough handling and long journeys under severe conditions. That is why so many industries rely on Metal Containers for drums. Leakproof, tamperproof drums that keep their contents intact throughout the longest journeys are made in a wide range for many purposes. Metal Containers have solved many packaging problems—may they solve yours?



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M-W.109

HIGHGROVE, CALIFORNIA. California Electric Power Company's new, modern 60,000 KW steam-electric generating plant now in commercial operation here was designed, engineered and constructed by The Fluor Corporation, Ltd. Many design innovations make this plant one of the most unique in existence. Except for the control rooms and switch gear the plant is completely outdoors and was planned for operation with an absolute minimum of attending personnel. The entire job was completed in advance of the originally scheduled operating date notwithstanding the extreme difficulty of obtaining some items of material and equipment. Additional units are being added to bring the total output to 140,000 KW.

Fluor's ability to build efficient power plants has been ably demonstrated many times and is recorded in the illustrated brochure, "The Highgrove Story." Copies are available upon request. Fluor's broad experience also extends into the design and construction of all types of facilities—from the smallest unit to the largest—for the petroleum, natural gas, chemical, petrochemical and heavy industries anywhere in the world.

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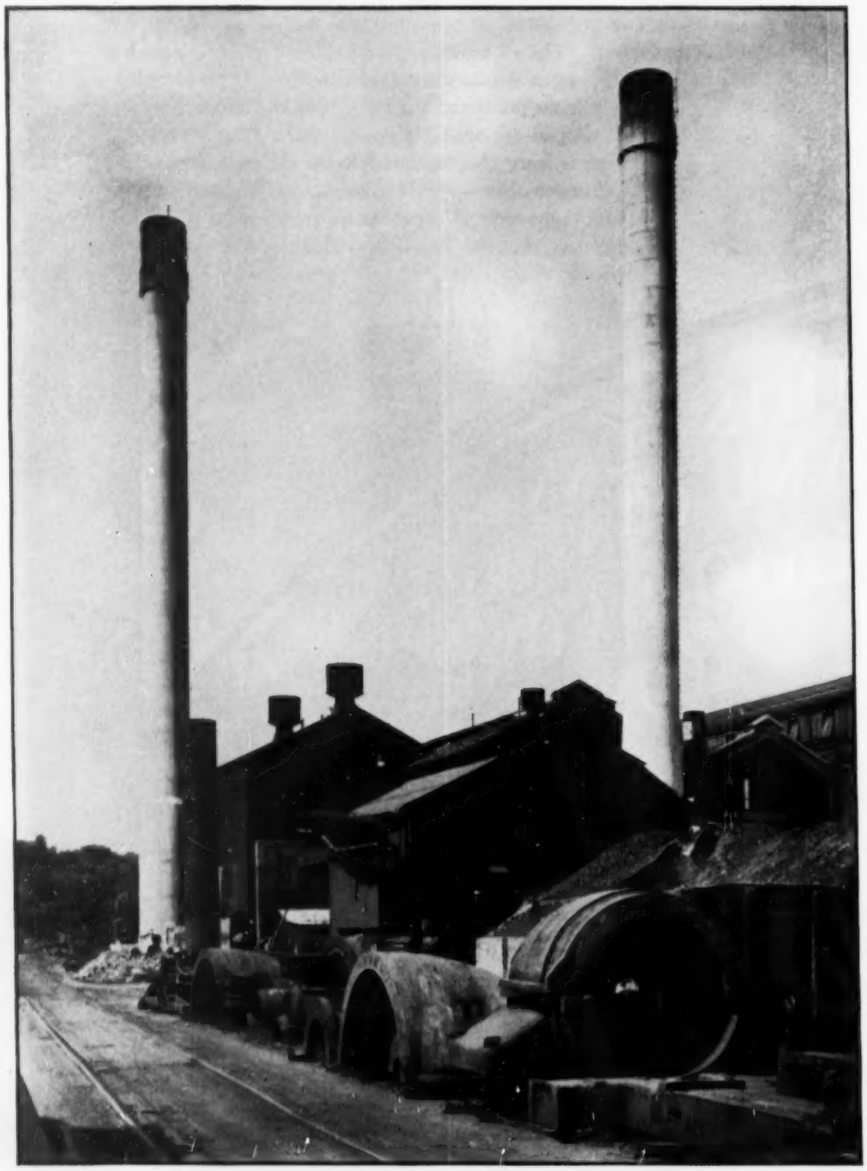

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During the last 40 years Tileman's have designed and constructed re-inforced concrete chimneys for every kind of industrial undertaking. Up to date they have built nearly 200 chimneys, in countries as far apart as England and Australia, ranging up to a height of 480 feet in that constructed at Oran in 1950.

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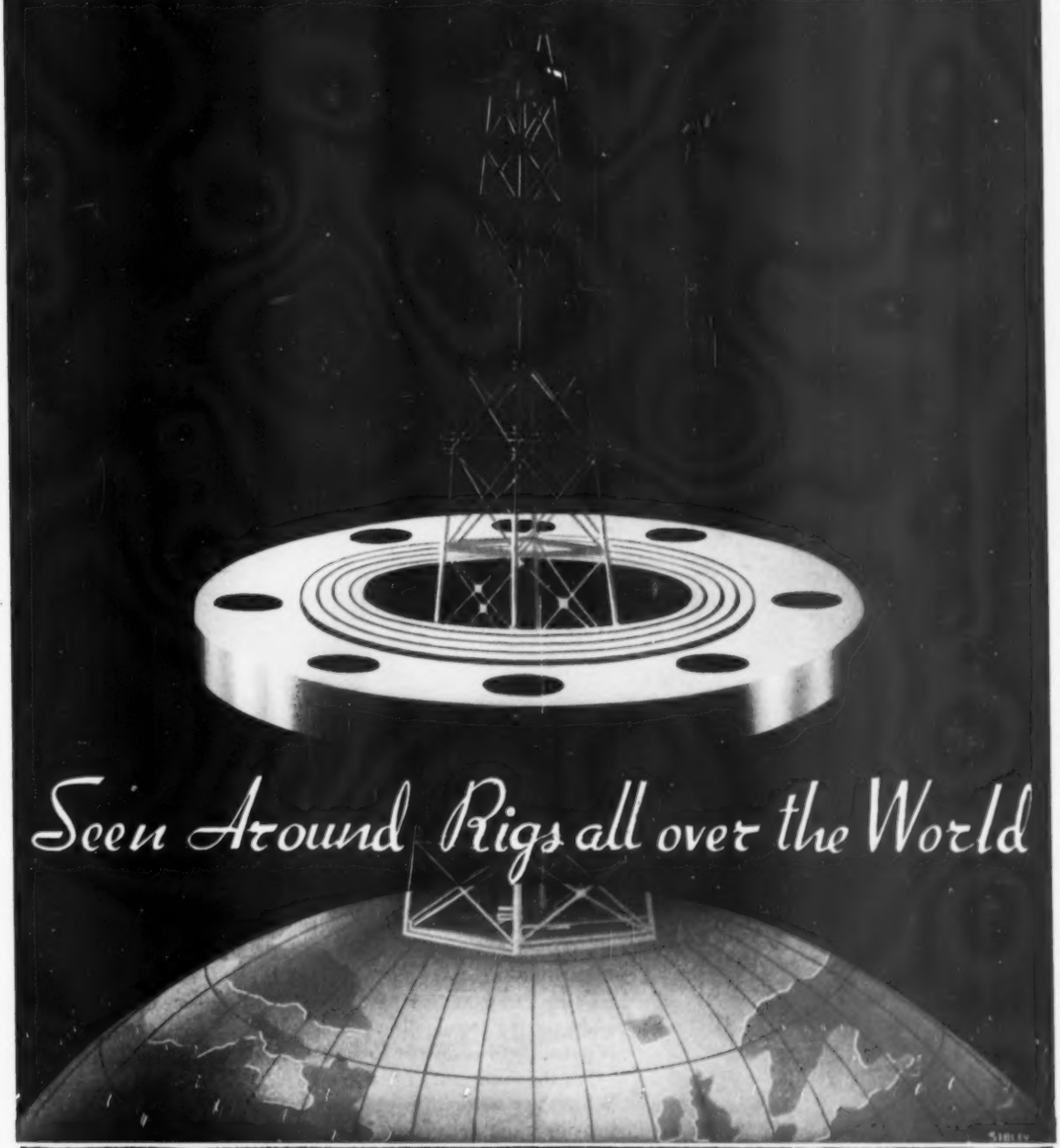

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Efficient White Trucks Are Sure Way To Save Time . . . Do More Work

This White 3000 is equipped with 2,480 gallon tank with 3" pump that delivers 174 gallons per minute in airport refueling service.

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White Distributors and Dealers in all principal markets of the world can provide facts about the advantages of White Trucks for your transportation service.

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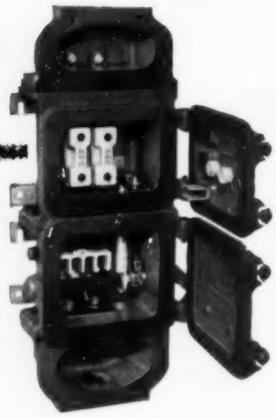
To B.S. 229 & B.S. 861

660 v. switch fuse unit with terminal box.



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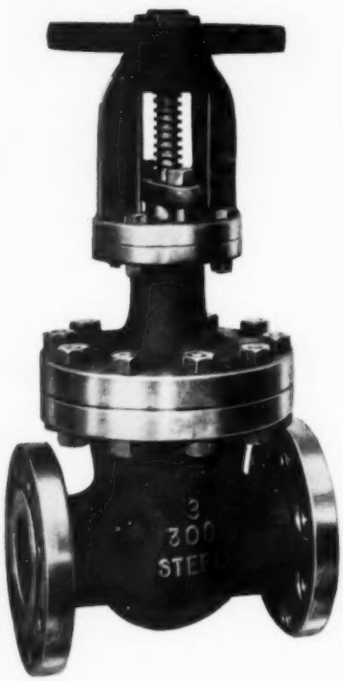

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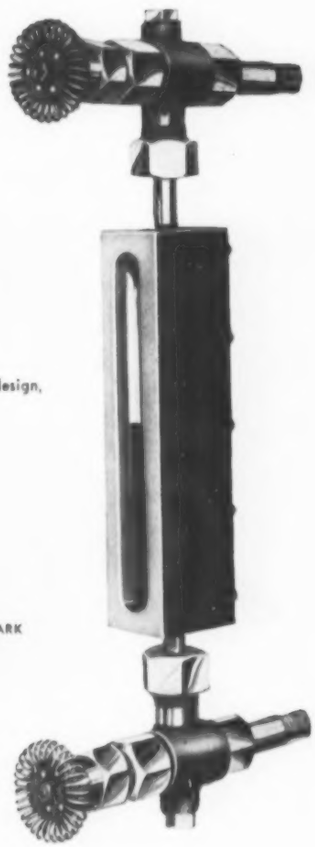

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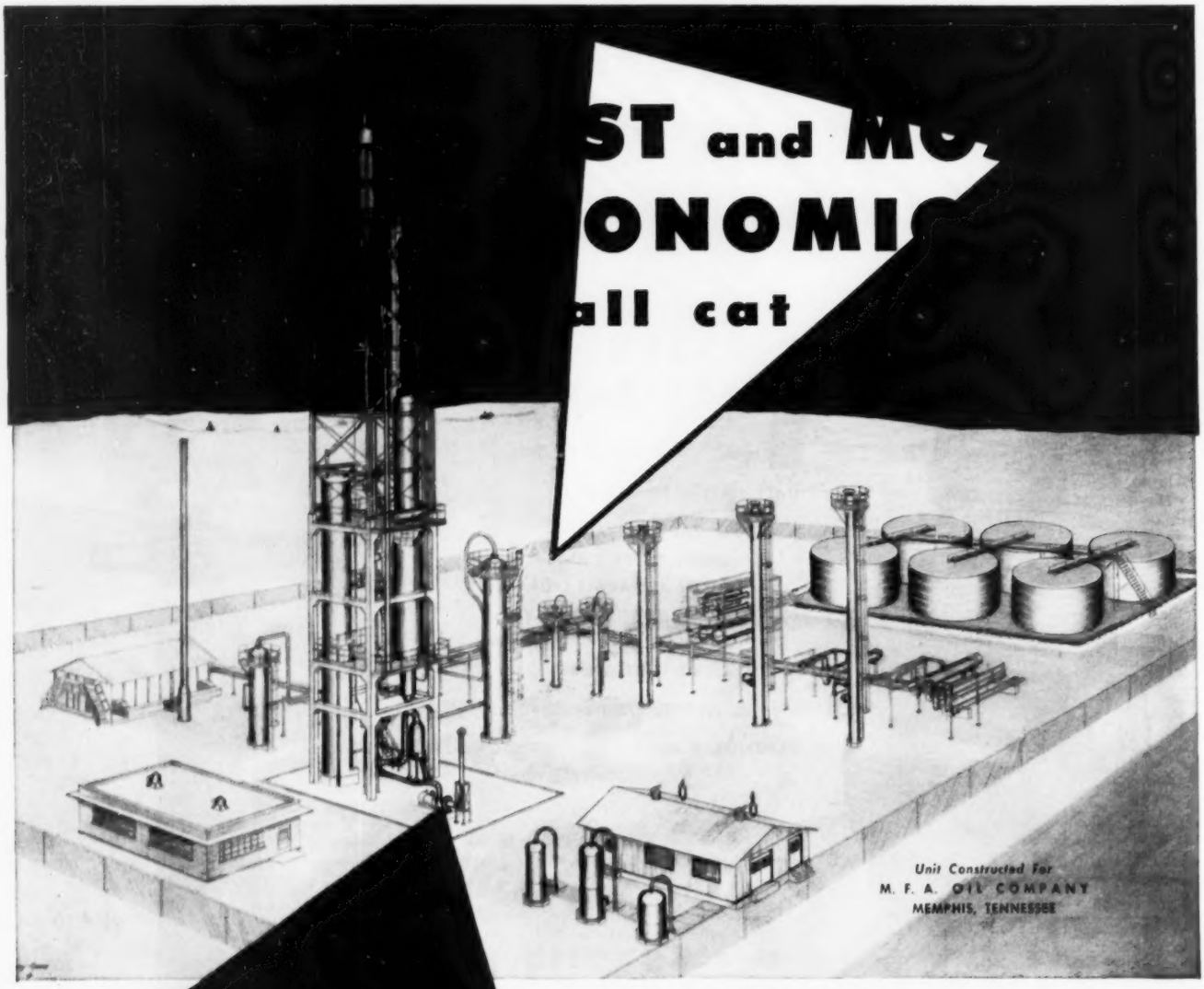

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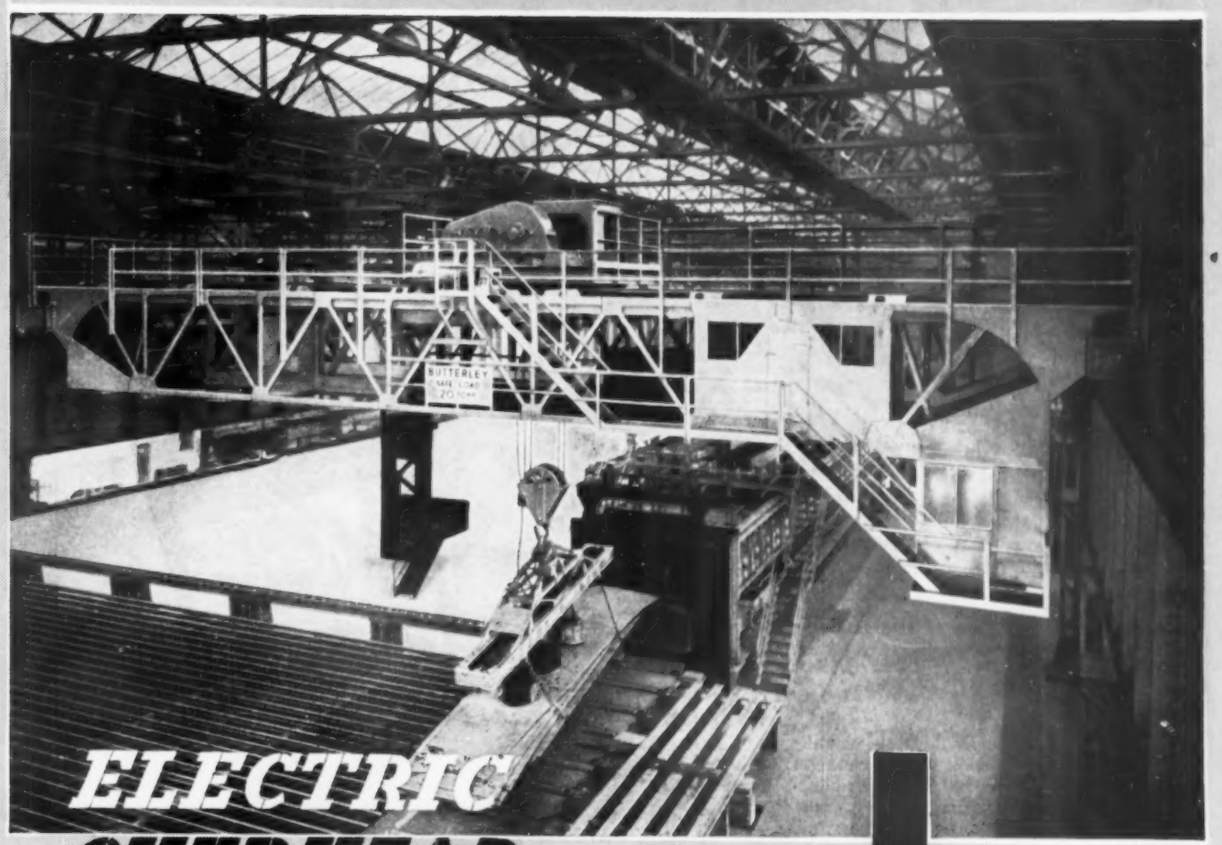
The capacity of this Socony Air-Lift Catalytic Cracking Unit ranges from 1,500 barrels per day of fresh gas oil feed at 90% conversion to 3,000 barrels per day of fresh gas oil feed at 50% conversion. Standard units are available also for greater capacities.

We will be glad to submit information on any refining process to fit your requirements. *Write us today, no obligation.*



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FOR SEVERE THROTTLING AND FLOW CONTROL SERVICES . . .

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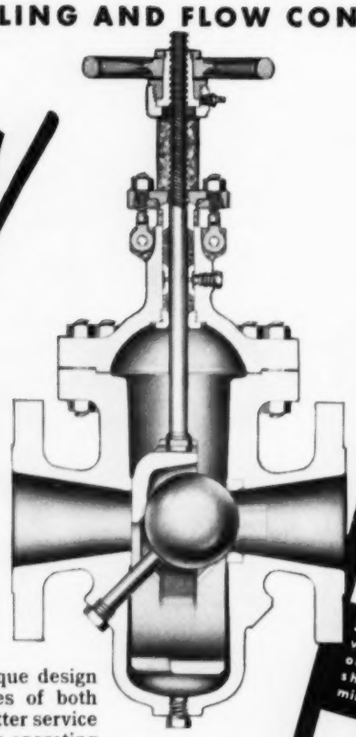
CRANE-PAUL
Venturi-Ball
VALVES

(Patented and Patents Pending)

CAST STEEL OR CRANE 18-8Mo ALLOY
Outside Screw and Yoke—Flanged. Available with sliding stem for assembly with power operators.



Fully closed with ball disc locked in outlet port. Ball seldom seats in same position, thus minimizing wear and erosion.
Smooth opening begins when ball cage "rolls" ball out of its seat. Crescent-shape opening permits minute throttling.
Inclined surfaces in the cage lift the ball disc clear of the seating surface.
Fully opened with U-shaped bottom of cage bridging the gap in body to form a continuous flow passage.

Meet the Crane-Paul Valve—a unique design that combines desirable advantages of both gate and globe valves. It provides better service and longer life under more rigorous operating conditions than such valves normally stand. These features include—

Exceptionally accurate throttling with a minimum of wear and erosion, resulting in long-lived seating surfaces.

Straight-through, non-turbulent flow—with pressure drop characteristics approaching those of venturi-type gate valves.

Smooth, easy response throughout the entire range of operation.

Completely tight shut-off.

Heart of this new Crane-Paul Valve is a precision-ground ball disc which rides loosely in a cage direct-connected to the valve stem. In operation, the ball is moved to and from the center of flow and rolls into and out of the body seat. At no time during valve operation does the ball spin or chatter, even in closely throttled positions. It revolves just enough to provide a new seating surface each cycle. In the closed position, part of the ball actually protrudes into the outlet port where it is tightly seated by the wedging action of the ball cage.

Literature Sent on Request

Full information on this new Crane-Paul Valve is in your Crane 53 Catalog. Literature is available from your Crane Representative or on request to address below.

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150-Pound, Sizes 1 through 6"
300-Pound, Sizes 1 through 8"
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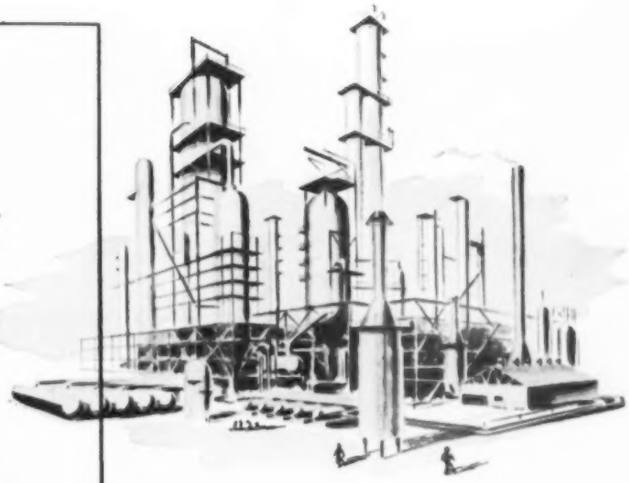
a new refinery for INDIA

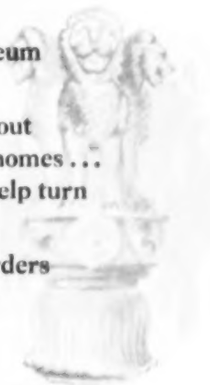


to help raise the pulse beat of industry

Standard-Vacuum has started to build a full-scale petroleum refinery at Bombay*, at a cost of 35,000,000 dollars.

Each year this new installation will be capable of turning out 40,000,000 imperial gallons of illuminating oil for Indian homes . . . *plus* 250,000,000 gallons of other petroleum products to help turn the wheels of India's industry, agriculture and transport.

The manufacture of these oil products within India's borders will serve to strengthen the economic foundations of her freedom and social progress.



**The refinery will be built and operated by the newly formed Standard-Vacuum Refining Co. of India (Ltd.), a subsidiary of Standard-Vacuum Oil Company.*

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Canada demands the best, and we, in Canada, plan to supply it. Our furnaces should be on tap by the Fall.

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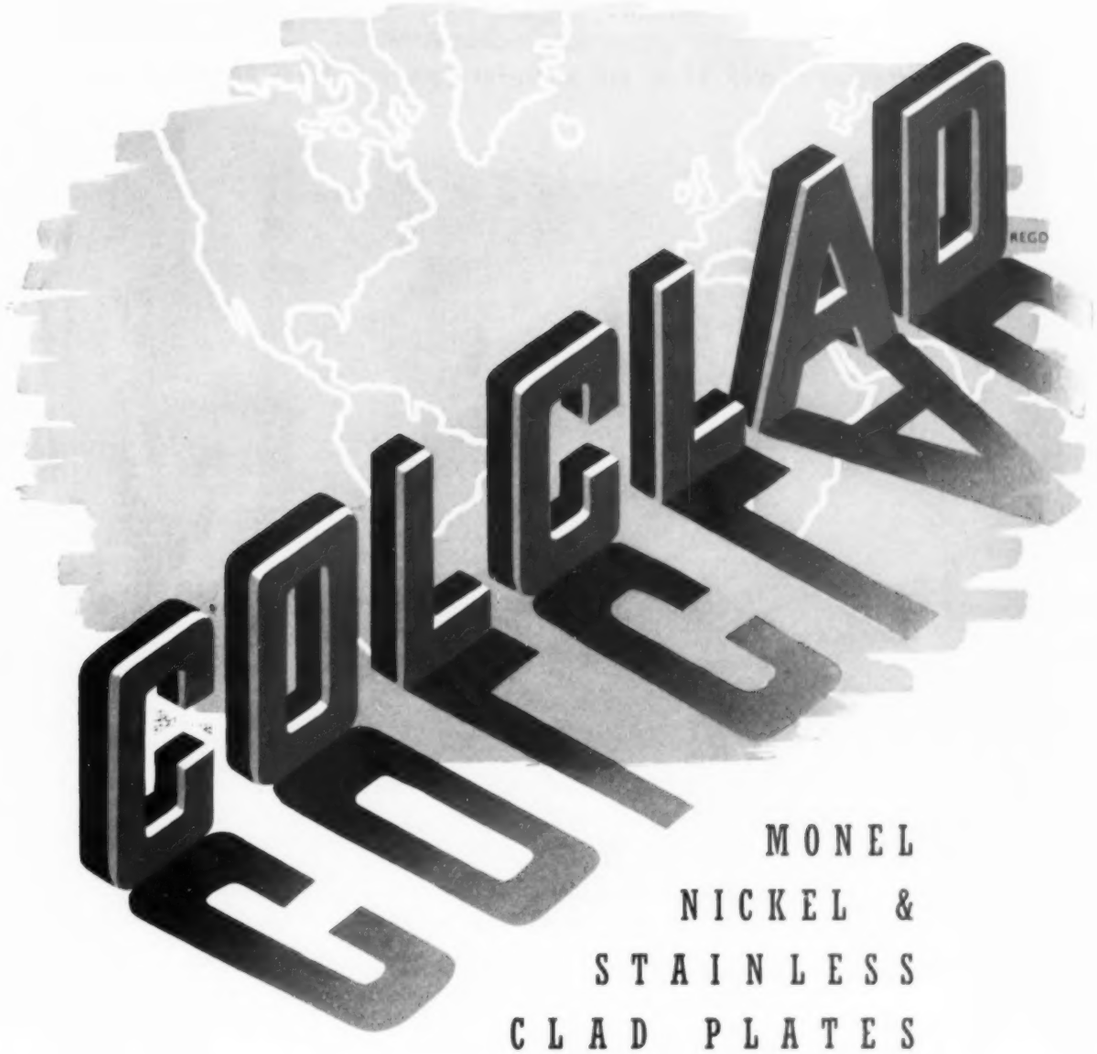

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We invite your enquiries for these special quality products,
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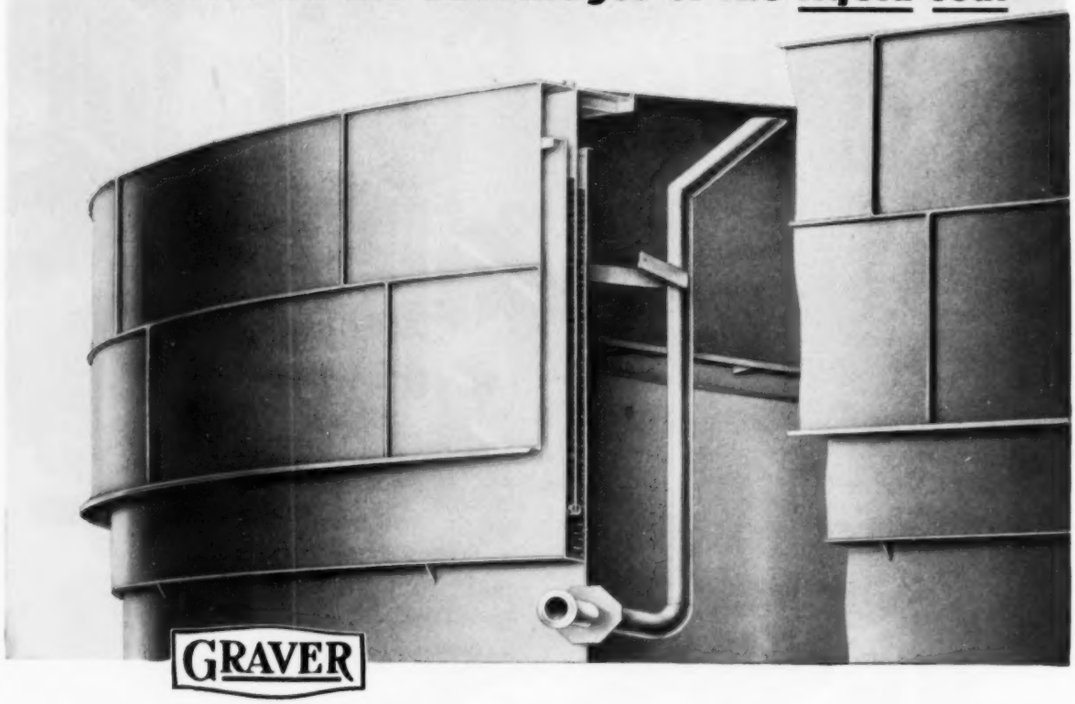
ONLY THE GRAVER EXPANSION ROOF

...offers all the advantages of the liquid seal



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High operational efficiency shown over a decade

...Low maintenance equals that of cone roof tankage
Easy manifolding affords terminal-wide protection

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...Removable weather hood facilitates inspection
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Underwriters' Laboratories asserts Graver Expansion Roof conducive to reduction of fire hazards

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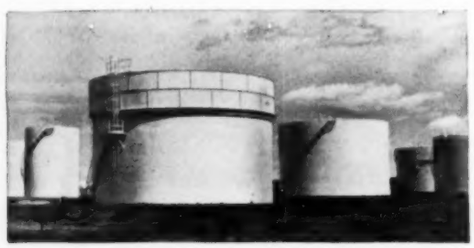

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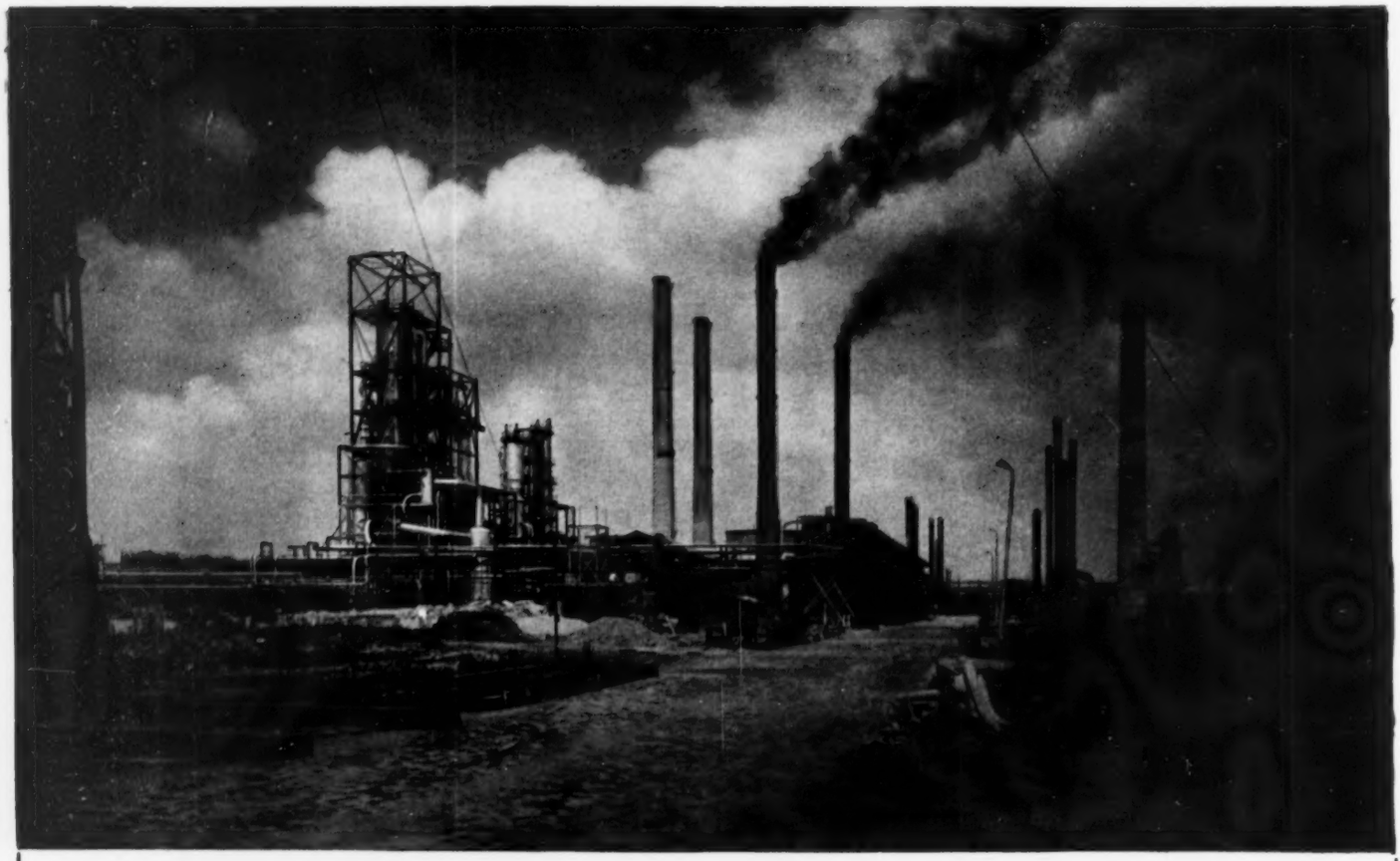

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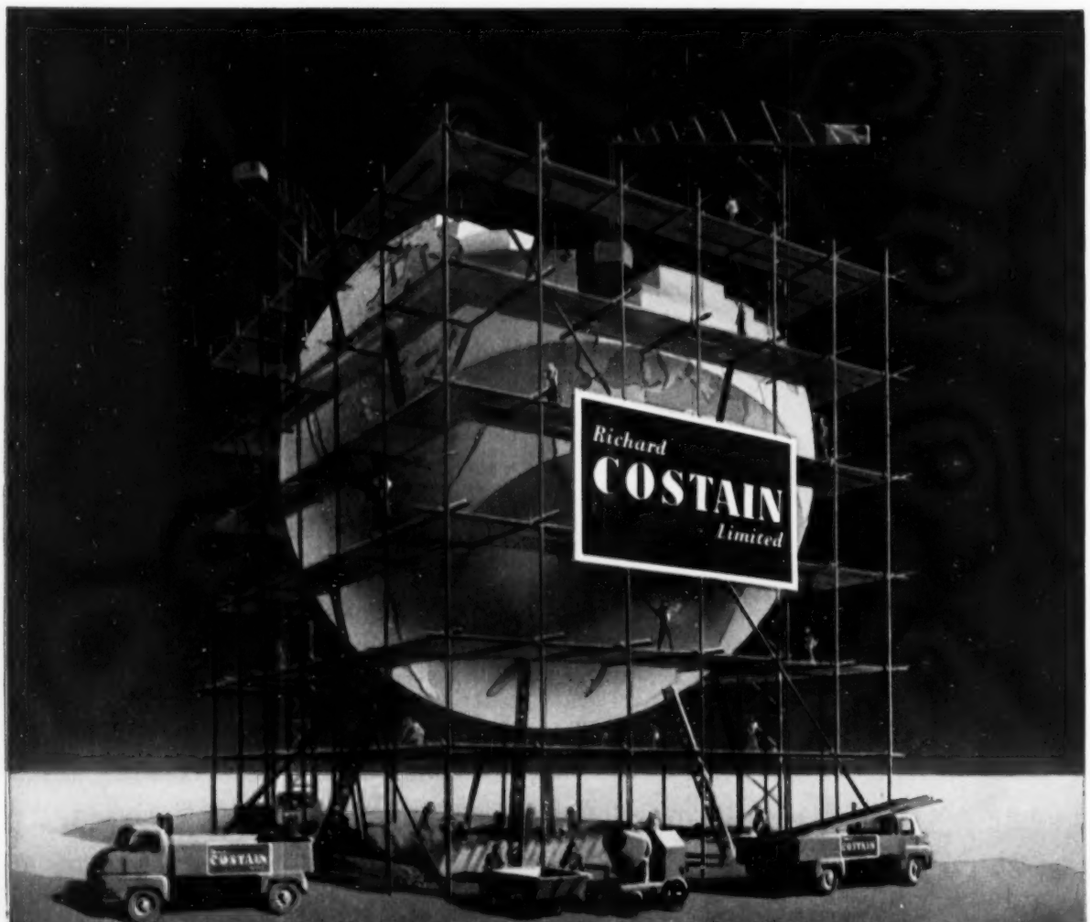

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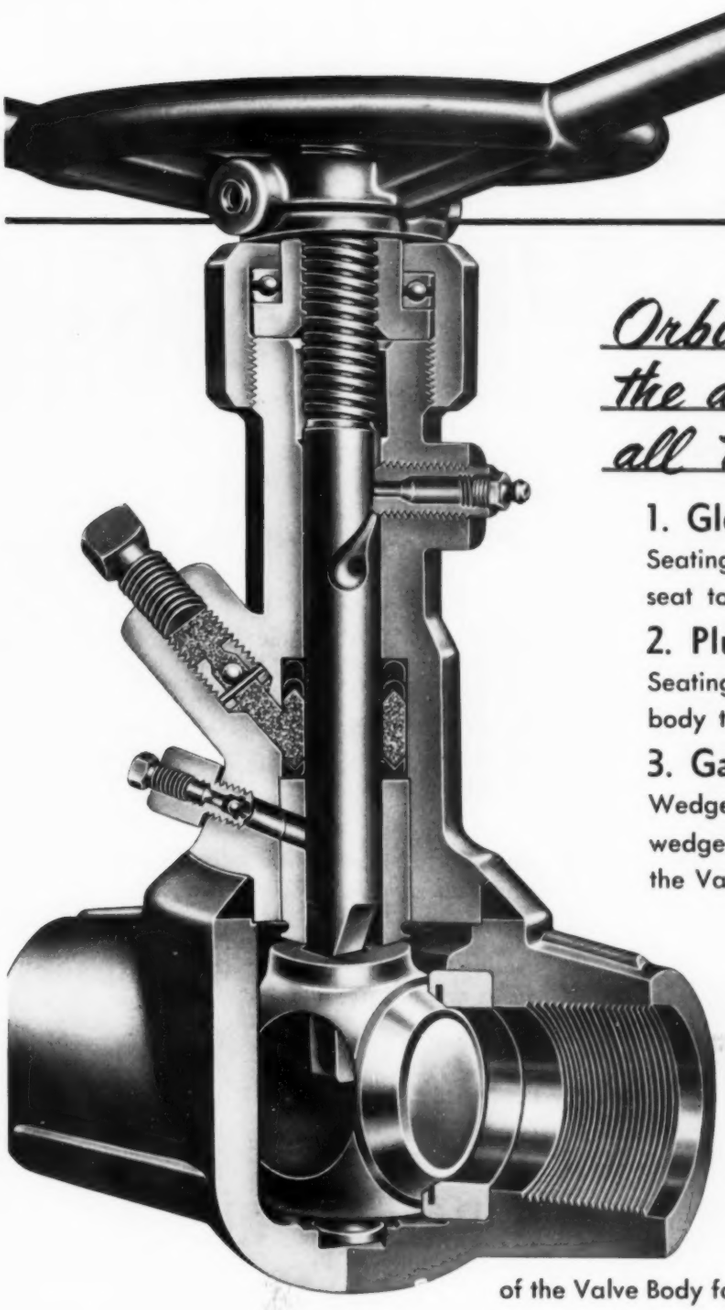

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Orbit provides the advantages of all three....

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1. **Well designed, close fitting Seals; including Primary, Secondary, and Top Seals for maximum conservation.**
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3. **Pontoon compartments Deep and Roomy so they may be easily entered and inspected for maintenance if necessary.**
4. **Pontoon compartments uncluttered with framework for easy inspection and maintenance.**
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6. **Roof designed to take ALL LOADS to which the structure may be subjected, with better than normal safety factor.**
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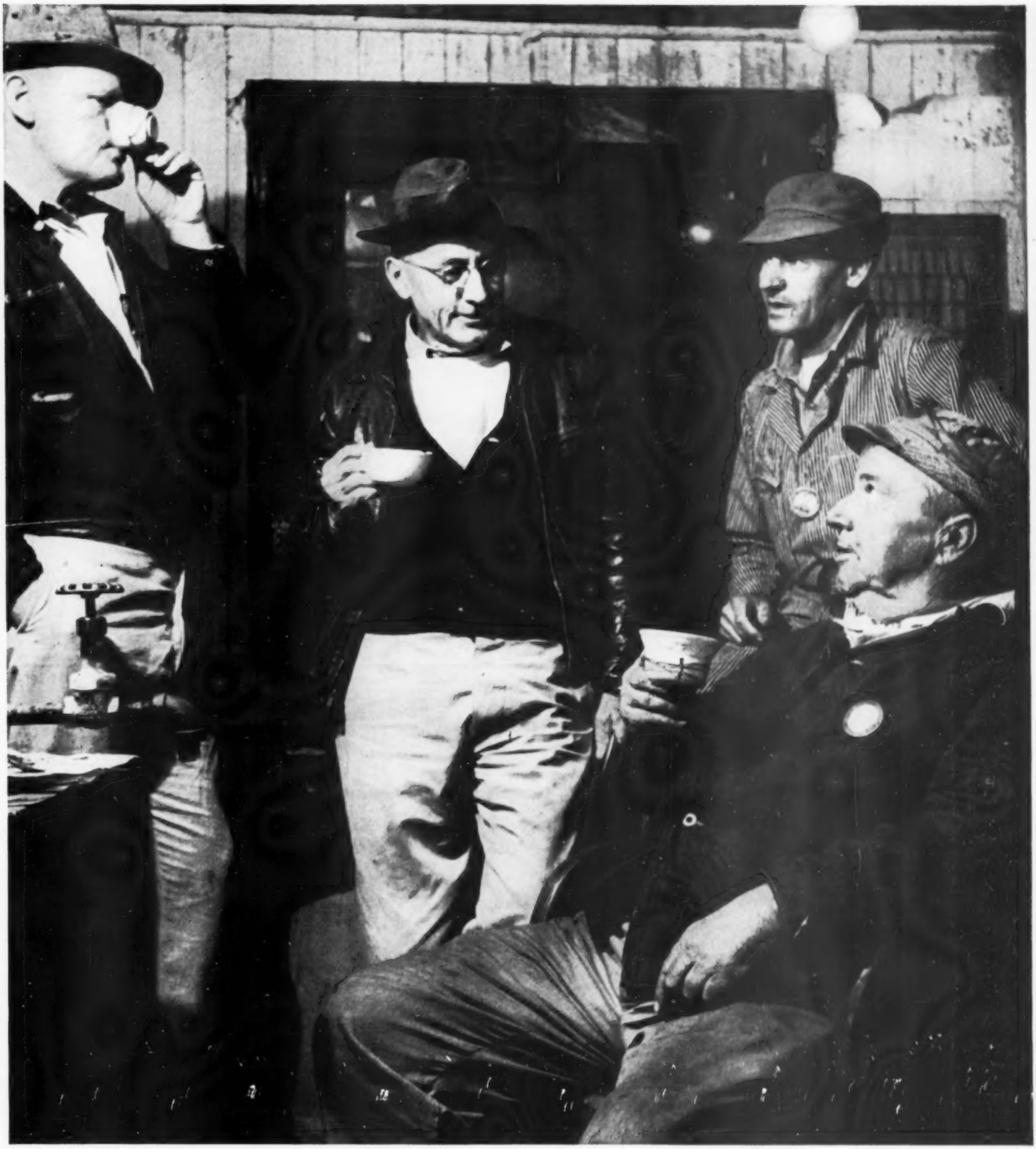

"The march up the steps of material progress depends not alone on the continued expansion of scientific knowledge and on industrial daring and managerial skill, but also on political and social conditions. The basic requirement for progress is freedom – freedom to inquire, to think, to communicate, to venture. Without these conditions, the human mind and spirit will be so shackled that the availability of natural resources will be limited and we may exhaust the known sources of some needed material and find nothing to replace it."

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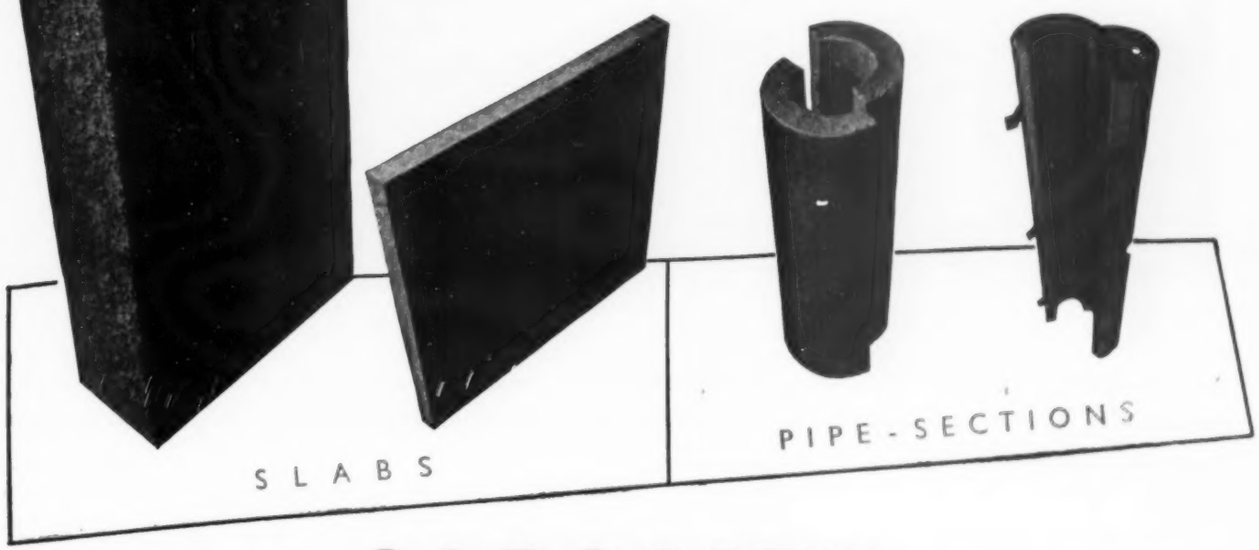

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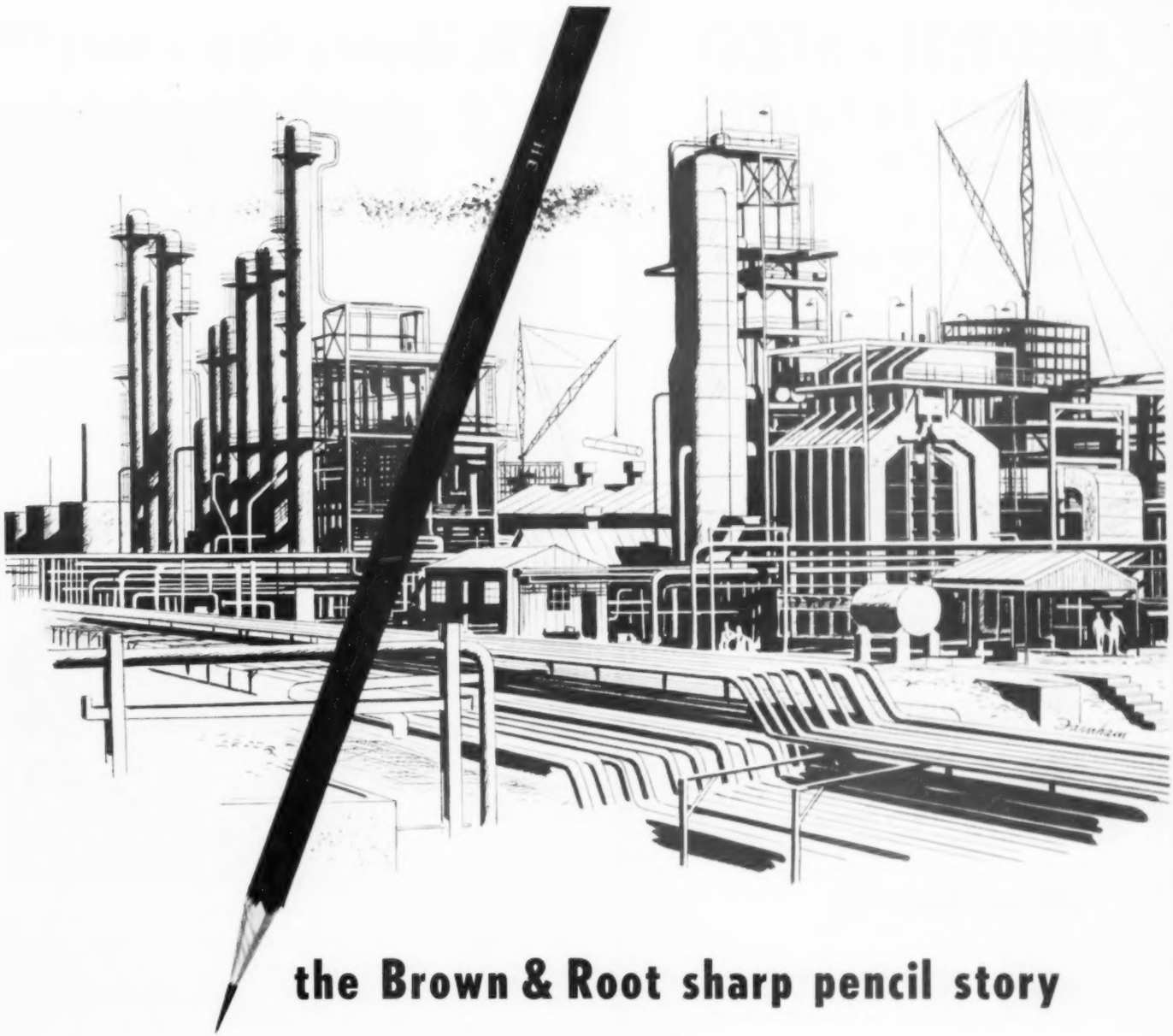

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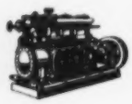

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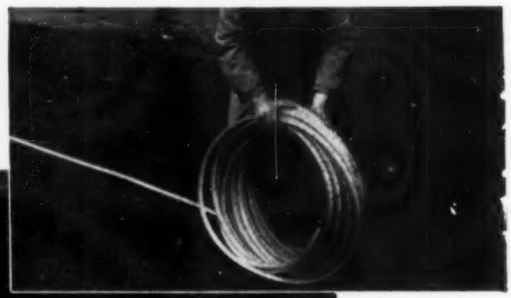
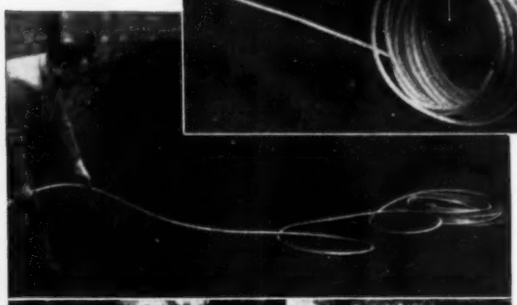
B1

IF ROPE COULD TALK . . .

"I'm mighty like a hose!"

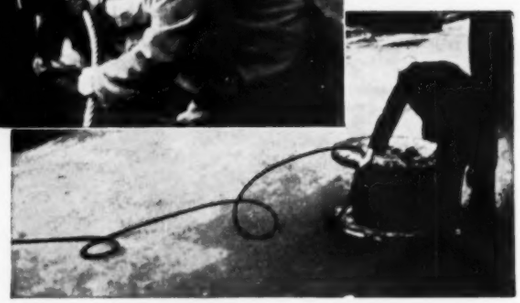
UNCOILING.
The right way, treated like a hose





—and the wrong way

UNREELING.
The right way, reel rotating freely



—and the wrong way

Good rope repays care in handling. Never allow kinks to form when UNCOILING or UNREELING a steel wire rope. Treat it like a hose pipe. A light coil of rope may be unrolled along the ground but should always be kept under control. A reel may be placed on a turn-table or mounted on stands and supported by a bar or tube through the hole in its centre. In no case should a coil or reel be laid on the ground and the end taken over; kinks will inevitably form and the rope's life and efficiency be seriously reduced. When COILING down a rope always put in under-turns as required to counteract the tendency of the rope to twist itself. Under-turning is simple — the rope itself will indicate that.

Write for a copy of a new booklet "If Rope could Talk".

British Ropes Limited

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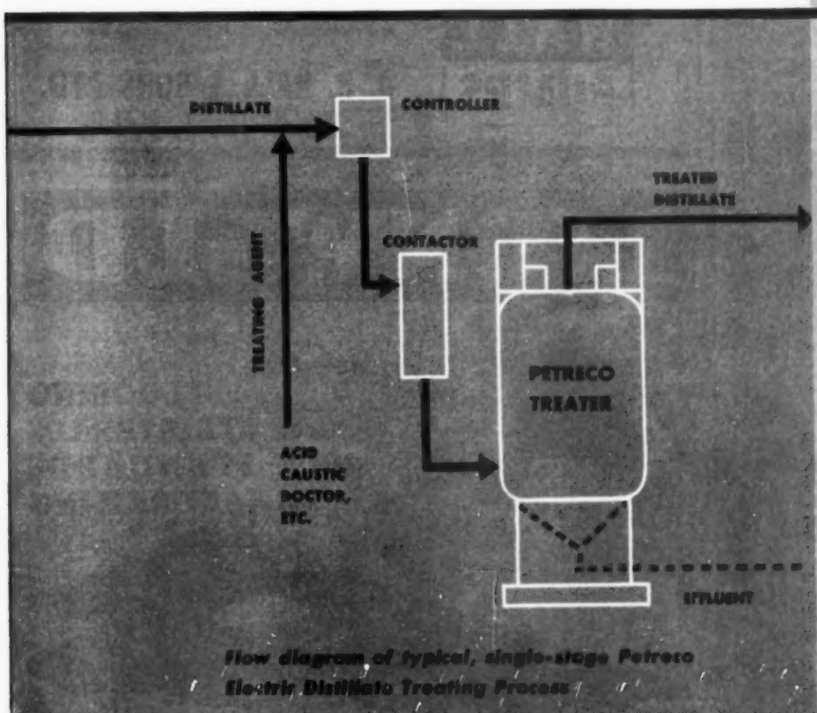
Be sure to get the facts on the ***NEW***

PETRECO

ELECTRIC DISTILLATE TREATING PROCESS

The new Petreco Electric Process takes the guesswork out of distillate treating. It is applicable to acid, alkali or doctor treating of distillate stocks such as naphtha, gasoline, kerosine, cat-cracker charges, cat-cycle oils, diesel fuel and furnace oil.



Flow diagram of typical, single-stage Petreco Electric Distillate Treating Process

ADVANTAGES

COMPACT — requires minimum space, minimum equipment.

ECONOMICAL — uses less treating agent, gives higher product yield.

AUTOMATIC — injection, contacting and separation are automatically precision-controlled.

RELIABLE — the automatic, precision-control assures definite, predictable results.

EFFICIENT—treated distillate is relatively free of pepper-sludge, caustic, doctor solution.

POSITIVE—assures a quick break and complete separation. Amount of acid-sludge is reduced and is more suitable for re-use or recovery.

NON-POLLUTING—the system is entirely closed. There is no chance for irritating fumes to escape.

COMPLETE—water washing is eliminated, except in some unusual cases.

EASILY MAINTAINED — the closed system, with no moving parts, stays clean; does not break down.

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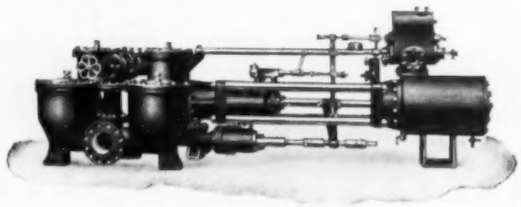

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"Hall" Horizontal Duplex and Horizontal Simplex type pumps are manufactured for almost every refinery service. Pumps can be supplied with steam jackets, elongated water cooled stuffing boxes, special type valves and seats etc. If required they can be fitted with proportioning pumps. Pump ends and internal fittings are of special materials according to the nature of the liquids to be handled. Modifications to suit any individual layout are incorporated as required.

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For handling oil in bulk, "Hall" Horizontal Duplex and Horizontal Compound Duplex type pumps have a proven record of reliability and efficiency, with maximum economy in operation. The "Hall" Compound Duplex pump is specially designed to give minimum steam consumption.

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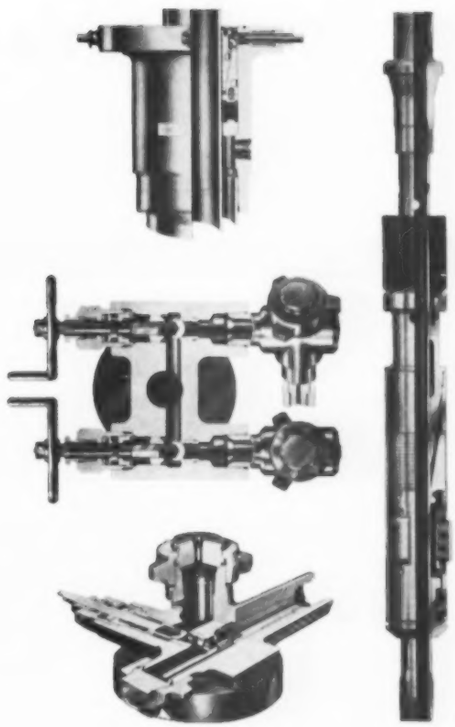
What one company do you think has done the most in the past five years to improve production equipment performance?



O-C-T "C-19" Casing Head . . . the first casing head designed specifically to eliminate open hole hazards in deep high pressure wells ● O-C-T "JE" Flow Control . . . effects cost and weight savings up to 90% ● O-C-T "JE" Dual Flow Control . . . replaces thirteen different fittings and saves as much as $700 ● O-C-T Packers . . . designed to eliminate the four major causes of packer failures.

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But never before in our history have we introduced as many truly outstanding products . . . products that have received immediate industry-wide acceptance . . . as we have during the past five years.

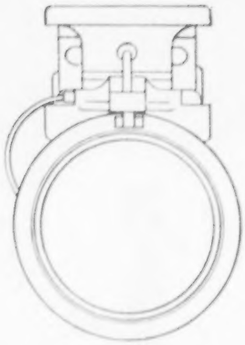
Each one of these new O-C-T products was designed to improve production equipment performance and safety . . . and industry acceptance has proved the need.

But rather than rest on these laurels, O-C-T has instituted an even greater development program to bring about other improvements in the future to meet future needs of the industry.

OIL CENTER TOOL COMPANY HOUSTON

O-C-T Products are available through more than 700 supply stores.

CANADIAN REPRESENTATIVE: **Tom Pickford, Phone 30437, 536 8th Avenue West, Calgary, Alberta, Canada.**



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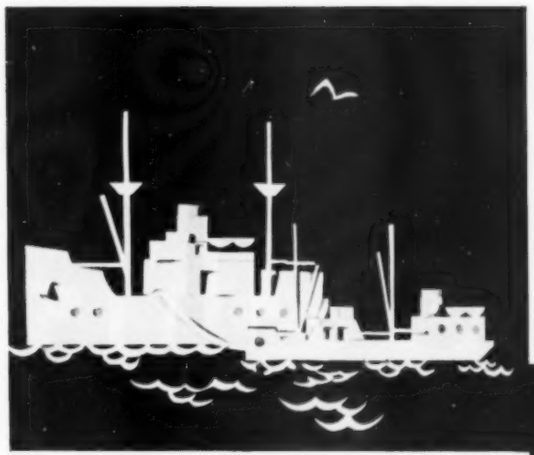

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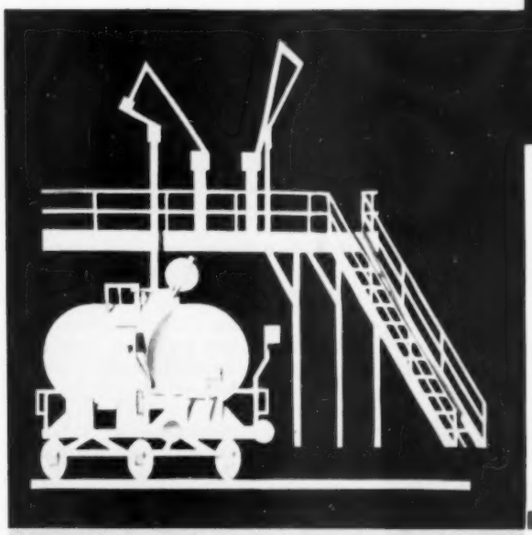

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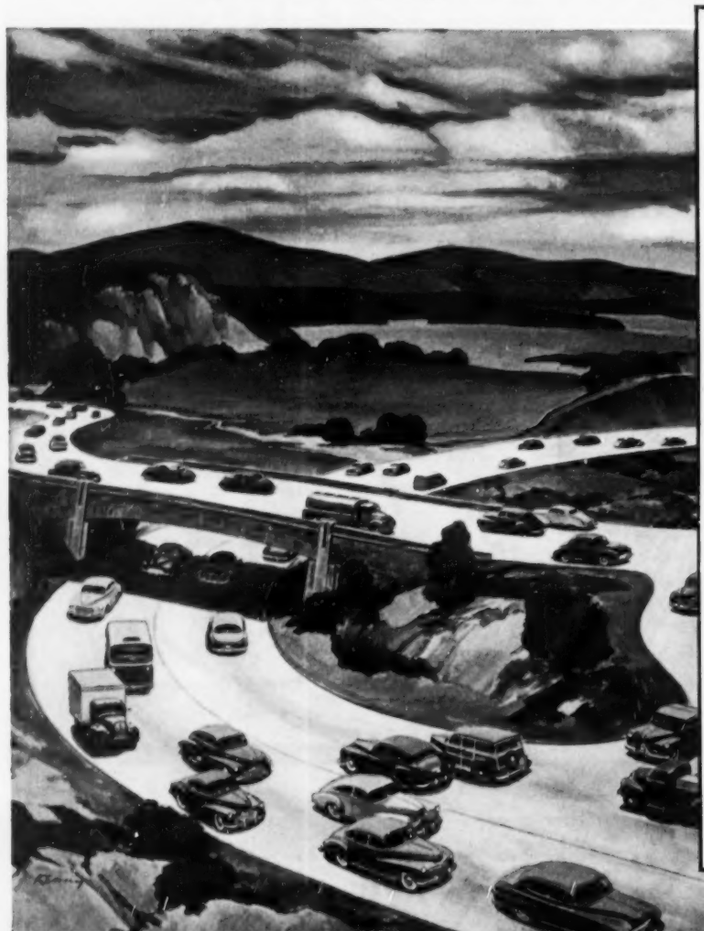

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THERE ARE over 43 million cars on the road—and they keep increasing at the rate of a million a year. Where is the gasoline coming from to supply this ever-growing number of motorists—and to meet the needs of industry and national defense?

Socony-Vacuum is helping supply the answer by *squeezing more gasoline* from every barrel of crude through improved catalytic refining processes. These new processes make it possible to produce high-quality blending stocks from any crude oil, thus making available greater amounts of higher octane gasoline.

Here are the facts . . . In 1945 Socony-Vacuum obtained a gasoline yield of 39% from a barrel of crude. Today 18% more gasoline—of 40% better performance—is obtained from each barrel . . . enough gasoline daily to take care of 1,100,000 additional cars from the same amount of crude oil.

Flying Red Horse research like this assures Mobilgas dealers a constant, plentiful supply of America's favorite gasoline brand!

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REFINERY PROCESS NEWS

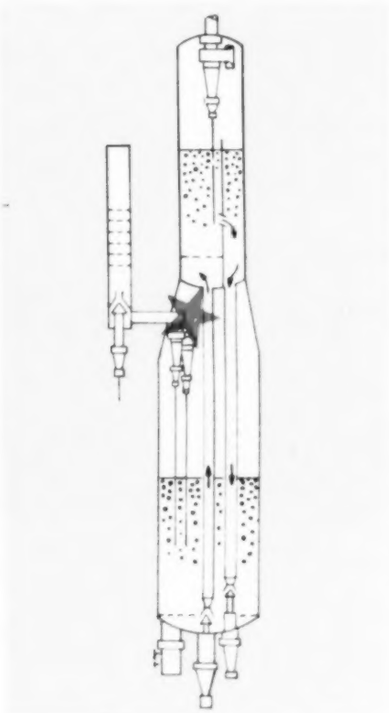
PUBLISHED BY REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAY 1953

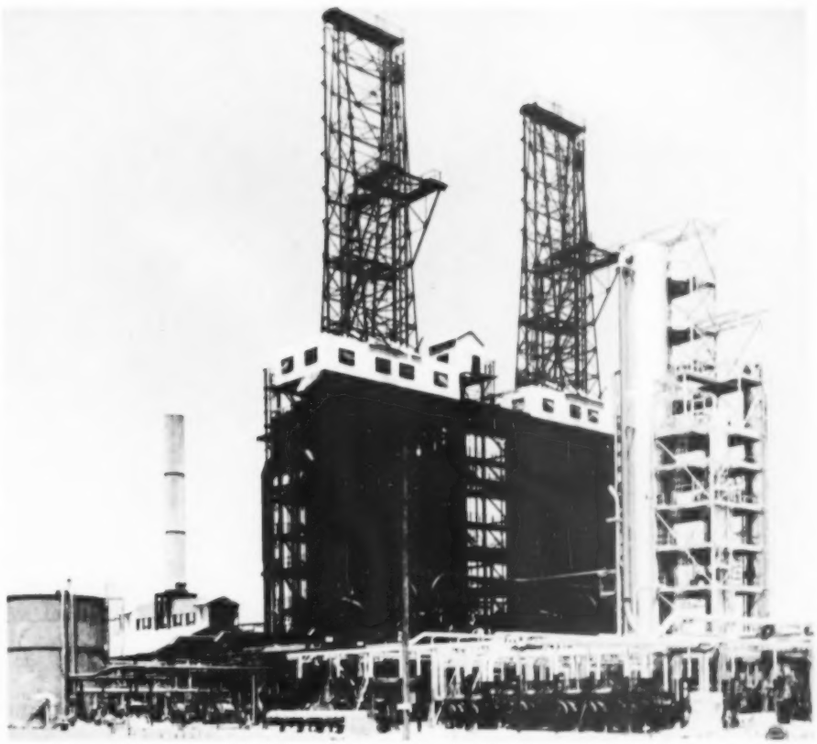
Simple Change in Orthoflow Unit Radically Reduces Catalyst Loss!

A comparatively simple modification in the regenerator of the first domestic Orthoflow unit has radically reduced amount of catalyst lost with stack gases. Tests over a period of better than two months prove that the catalyst loss factor of the Orthoflow is now as low as that of the best side-by-side Fluid units. Gasoline yields from this unit also continue to match the best yield records of the conventional crackers.

While designed for an 8300 BPD throughput, this first unit has been operating on synthetic MS catalyst at 9300 BPD — with conversion maintained at 67% because of the weak fuel oil market. In operation, the debutanized gasoline averages 93 octane clear, despite the fact that a certain percentage of naphtha is present in the feed.

The modification made in equipment to effect the catalyst saving does not alter the basic design of Orthoflow units nor affect their low investment advantages. Currently nine other Orthoflows are either operating, under construction or being engineered.





Changing Product Economics Increases Interest in Delayed Coking Process

In view of the deteriorating market for residual fuel oil in certain areas and no indications that it will greatly improve in the future, refiners in many parts of the country are reaching the decision that a coking step is the most logical solution to this economic problem.

Not only has the moderate winter piled up supplies of residuals in several sections of the country but basic industry uses have continued to slack off. Exports are down and no one can reliably predict that import restrictions will not be lifted.

While this situation does not obviate the use of other feed preparation steps (for example, Kellogg was named just recently to design and erect a 55,000-BPD vacuum flasher on the West Coast and is currently building a 28,000 BPD solvent deasphalter on the Gulf Coast) it does place Delayed Coking in a key position.

Petroleum coke is marketable today in virtually every part of the country — in contrast with the situation a few years ago when it had value only as refinery fuel in a number of locations. Further its price ranges as high as $10 a ton or more, depending on quality. In addition to customary uses, there is an increasing demand for petroleum coke in the manufacture of the carbon electrodes used in aluminum production. Roughly seven-tenths of a pound of petroleum coke is required to produce one pound of primary aluminum.

All-in-all, it appears that the U. S. and Canada will consume well over a million tons of petroleum coke this year. By 1955, this same potential market may rise by nearly 50%.

The following brief economic evaluation of two major feed prep steps highlights their economic relationship under current market conditions. The study is based on

(continued on following page)

REFINERY PROCESS NEWS

CONTINUED FROM PRECEDING PAGE

Delayed Coking . . . cont.

a typical refining sequence including recycle Fluid cracking, thermal reforming of naphtha, cat poly and alkylation. Feed was established as 40,000 BPD of 38.6° API paraffinic crude, topped to 32.5% bottoms, plus 4000 BPD of 26 lb. casinghead.

YIELDS, VOLUME % ON CRUDE

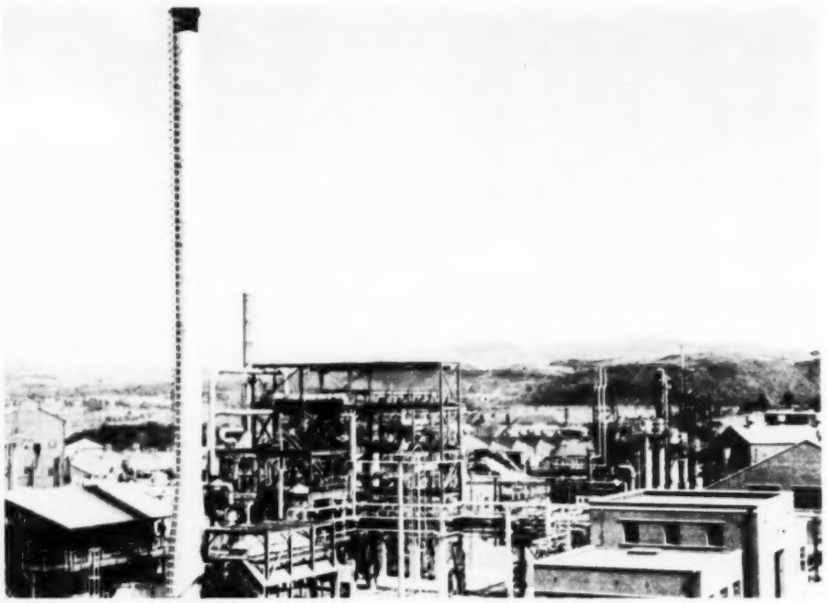
	Vacuum Dist.	Delayed Coking
Premium Gasoline–93 CFR-R	13.2	14.0
Regular Gasoline–86 CFR-R	54.1	56.1
Total Gasoline	67.3	70.1
Kerosene	12.0	12.0
Furnace Oil	11.4	10.7
Fuel Oil	10.1	3.0
Gas (fuel oil equivalent)	8.3	11.0
Coke (recoverable)	—	5.4

ASSUMED PRICE STRUCTURE

	Gulf Coast Unit Price	East Coast Unit Price
Premium Gasoline—93 CFR-R, per Gal.	$0.1225	$0.1385
Regular Gasoline—86 CFR-R, per Gal.	0.1125	0.1285
Kerosene, per Gal.	0.0925	0.1075
Furnace Oil, per Gal.	0.08625	0.0975
Fuel Oil, per Bbl.	1.63	2.10
Gas (fuel oil equivalent), per Bbl.	0.66	2.10
Coke (recoverable), per Ton	10.00	10.00

ECONOMIC COMPARISONS

	Delayed Coking
Incremental Credits over Vacuum Distillation, per year—	
East Coast	$1,207,000
Gulf Coast	1,153,000
Incremental Investments in Processing Equipment—	
East or Gulf Coast	1,400,000



New Low Cost Desulfurization Demonstrated

Recently completed at Llandarcy by Anglo-Iranian Oil Company, Ltd. this 3,500 BPD Autofining unit is typical of a type of plant now being licensed on a worldwide basis by Kellogg. In view of the increasing quantities of sour crudes being used by domestic refiners, a desulfurization process like this one could be of great importance to processors who are having difficulty meeting sulfur specs for diesel and heating oils.

Autofining is fixed-bed catalytic desulfurization designed to treat all types of distillate stocks except those which include a high percentage of unsaturates. It is a low temperature, moderate pressure, high space-velocity process which provides an excellent low cost means of producing sweet distillates from sour crudes with extremely low liquid volume losses and with high sulfur reduction.

For a unit of 3,500 BPD capacity, the direct operating cost per barrel of feed ranges from about 11 cents for gas oil to 10 cents for kerosene. This can be compared with conventional sulfuric acid treating costs of 48 and 16 cents respectively. Investment cost for an Autofining unit is somewhat greater than that for acid treating. Nevertheless, incremental payout time for the new process over acid treating is approximately one year for gas oil operation and slightly longer for kerosene operation, depending on sulfur reduction.

For further information, technical data, etc., on any refining process, write

ARGENTINIAN REFINERY . . . 75% COMPLETE

Work has reached the 75-per-cent-completion stage on a 28,300-BPD catalytic refinery in the Argentine. The new plant is being erected by Yaciementos Petroliferos Fiscales at Eva Peron (formerly La Plata) and will be called the Presidente Peron Refinery.

Shown are two of the major units, vacuum distillation to the left, and straight-run gasoline fractionation to the right. Other units, being constructed by YPF under the supervision of Kellogg Pan American Corporation, include a Fluid catalytic cracker, an alkylation unit and one of the world's largest Delayed Cokers. In addition, there will be two crude units, one of 21,000 BPD capacity and the other charging 7300 PBD. Thermal cracking and catalytic polymerization are also part of the sequence.

REFINERY PROCESS DIVISION
THE M. W. KELLOGG COMPANY
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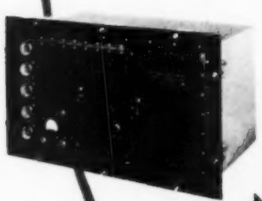
OUT HERE ...IT'S Instruments versus Elements

A marsh-type seismometer specially designed to permit deep planting (dimensions 1½"x10").



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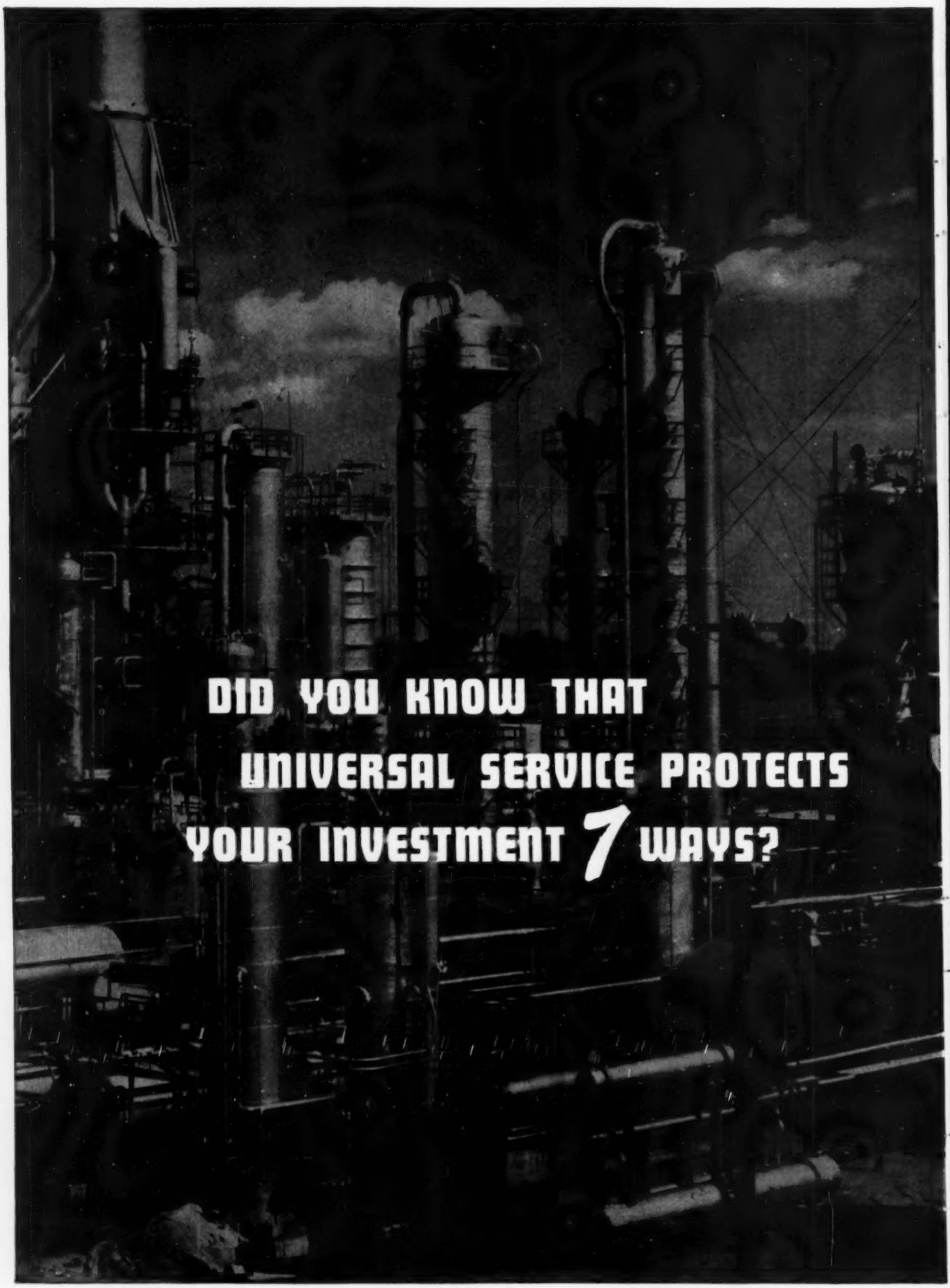
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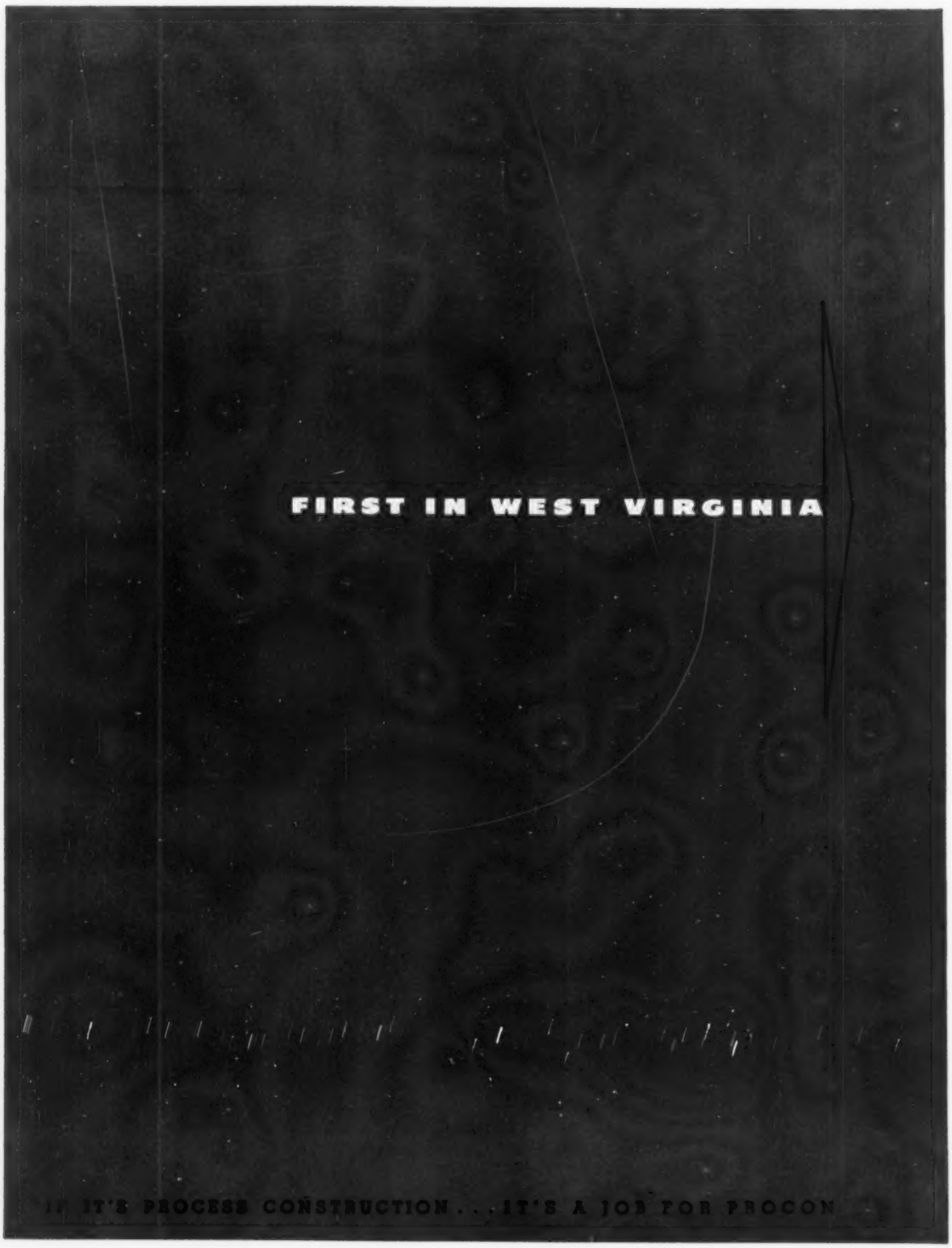
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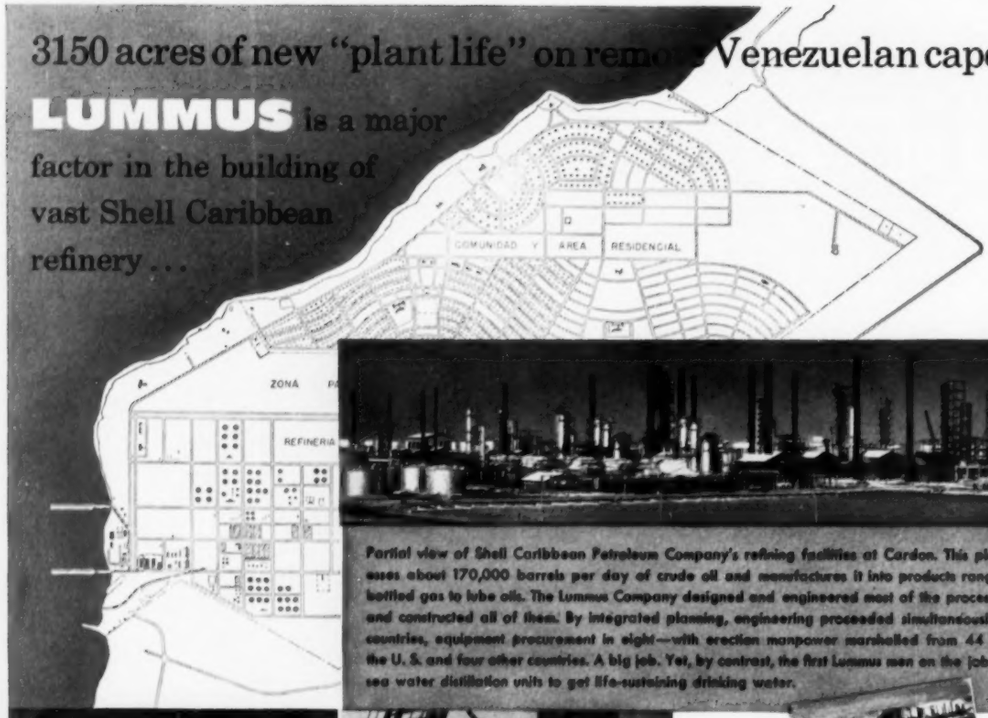
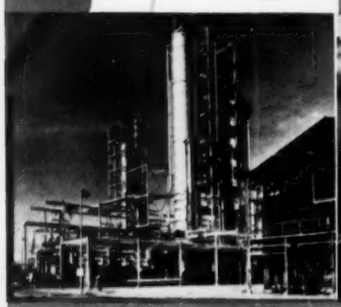
LUMMUS is a major factor in the building of vast Shell Caribbean refinery...



Partial view of Shell Caribbean Petroleum Company's refining facilities at Cardon. This plant processes about 170,000 barrels per day of crude oil and manufactures it into products ranging from bottled gas to lube oils. The Lummus Company designed and engineered most of the processing units and constructed all of them. By integrated planning, engineering proceeded simultaneously in four countries, equipment procurement in eight—with erection manpower marshalled from 44 states in the U. S. and four other countries. A big job. Yet, by contrast, the first Lummus men on the job installed sea water distillation units to get life-sustaining drinking water.



Cardon's Two Stage Atmospheric and Vacuum Distillation Unit No. 1 (shown here), and its two companion "stills", represent high development of the distillation art. Designed and built by Lummus, these basic plants are characterized by wide flexibility and closely controlled quality of fractionated products. Cardon is also the home of Venezuela's first lubricating oil plant—another in a long list of "firsts" for Lummus in the lube oil field.

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Just Off Press... our newest picture brochure, "New Horizons—Lummus at Cardon." Twenty-four pages covering this world-famous plant. May we send you a free copy? Just drop us a line at Room 359, 385 Madison Avenue, New York 17.

Shell-Cardon is a good example of why the Lummus name is well known in the petroleum, petrochemical and chemical fields—and respected for the ability to get big, tough jobs completed rapidly and economically.

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VOLUME 24, NUMBER 5

MAY 1953 CANADIAN REVIEW NUMBER

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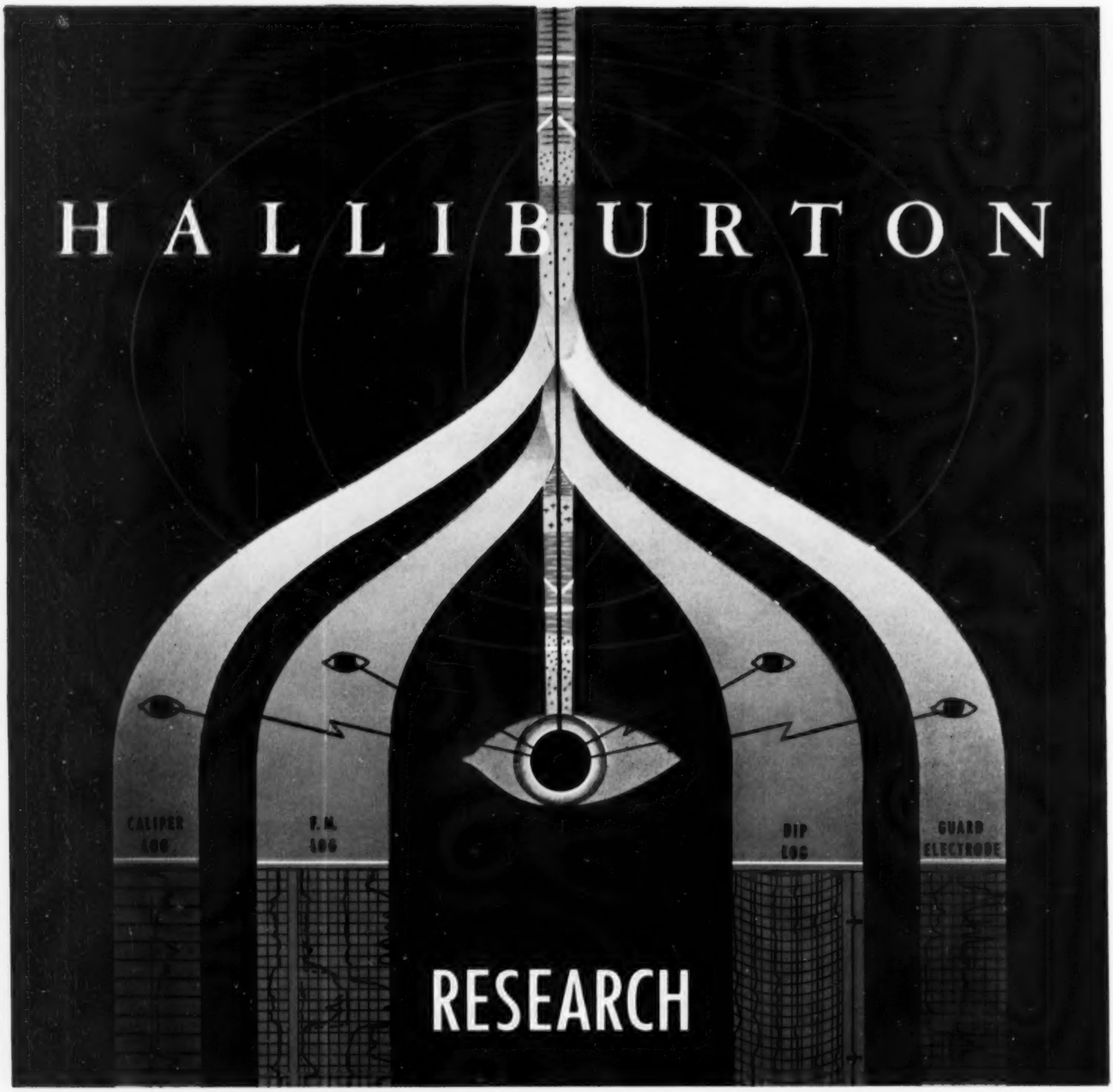
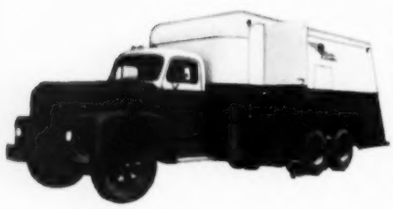
THIS MONTH'S COVER

Christmas tree at a well in the Duhamel field in Alberta, a Socony-Vacuum discovery, in the D-2. The field is in the New Norway-Malmo trend and still is in course of development. Reserves in the trend are currently estimated at 27.3 million barrels. Color plates are reproduced here through the courtesy of John P. Tolbert, editor of *The Flying Red Horse*, Socony-Vacuum house magazine. Another Duhamel well is pictured in the center above on this page. Left, an exploration crew calls at a northern trapper's cabin, and right, washday at a drilling rig in Alberta.



The Exploring Electrode of Progress



Someday, with advancing science, finding oil may be a certainty. Even now, exploring formations electrically has given oil finding its greatest lift. The all-seeing eye of the electrode reports down-hole data with much greater detail and accuracy. One of the first to use this force was Halliburton. And to learn that interpreting electric logs was a laborious and painstaking analytical process. Highly specialized interpretive techniques were developed, which in turn demanded improved instruments. This has gone on for years and years, a most important research project in Halliburton's modern laboratories at Houston. It accounts for Halliburton's leadership in electrical well services and the recent developments of Guard Electrode Logging, FM Logging, and Dip Logging. These major contributions to modern exploration and production demonstrate decisively that research is the exploring electrode of progress.

HALLIBURTON OIL WELL CEMENTING CO., DUNCAN, OKLAHOMA

PERPETUAL PROGRESS IN PRODUCTION IMPROVEMENT TECHNIQUES

NEW CHAPTER OPENS FOR CANADIAN OIL

SIX YEARS have passed since the discovery at Leduc opened a new era for Canada's petroleum industry. It has been a period of rapidly expanding exploration and development in which nearly two billion dollars of Canadian and United States funds have been invested. The center of activity has been the Province of Alberta where the first important discoveries were made, but geophysical prospecting and exploratory drilling have extended the area of commercial production from Manitoba in the east to British Columbia in the west, a distance of a thousand miles.

The growth in proved reserves during this initial period has been of the order of 1.7 billion barrels of oil and an estimated ten trillion cubic feet of natural gas. Within the past two years, completion of the Interprovincial Pipe Line from Edmonton to Lake Superior, together with tanker facilities on the Great Lakes, has permitted a rise in production to approximately 170,000 barrels daily, or about 37 percent of the Dominion's requirements. The significant result of this preliminary work has been to determine definitely that western Canada is one of the world's great oil reservoirs, capable not only of supplying Canada's rapidly growing requirements, but also of taking a place among the world's petroleum provinces.

With the auspicious beginning of the past few years and with the assurance of far greater resources to be uncovered, Canada's industry enters upon its second highly important stage, that of providing transport and processing facilities capable of dealing with a greatly increased volume of production and making its products available to much broader markets than have been open to them in the past. While surveys, exploratory and development drilling all are moving to a higher tempo in view of the broadening prospects of the industry, special emphasis is being placed in 1953 upon enlarging facilities for transport and processing which in turn will invite higher production.

The first big step toward opening broader horizons to the oil of western Canada was taken two years ago when the 1,127-mile Interprovincial pipe line was put in operation from Edmonton, Alberta, to Superior, Wisconsin, connecting there with lake tankers which conveyed it to refineries in Ontario. During its first year, the line delivered an average of 40,000 barrels daily. By the time of its completion it was evident that it was inadequate to accommodate the growing output of Alberta crude on the one hand or the rising demand for petroleum products in the eastern provinces on the other. Furthermore, since the tanker movement was limited to the open season of lake navigation, it was necessary to install a large amount of storage to maintain a continuous supply.

Steps were taken therefore for looping part of the line to add to its capacity and plans were drawn for building a new pipe line to extend all the way to eastern refineries. During 1952 the line has been moving roundly 60,000 barrels daily eastward. Now the project for a through land line from Superior to Sarnia, Ontario, almost 1,800 miles in length and of 30-inch diameter, is taking form and will rank on completion among the great oil transport systems of the world. In the west, 1953 will witness completion of another great system extending westward from Alberta across the Rockies to Vancouver in British Columbia. These two great arteries are expected ultimately to provide capacity for moving between 400,000 and 500,000 barrels per day and, with the product lines under construction, not only will enable prairie oil to reach all parts of Canada but also through deep water terminals will open the way to markets beyond the two oceans on which the Dominion borders.

Keeping step with the tremendous development under way in production and transportation is the multiplication of Canada's refining resources which have grown from 230,000 barrels per day in 1945 to 450,000 barrels in 1952, with new plants under construction or authorized for completion during the current year or in 1954 designed to add another 200,000 barrels of daily capacity. Aside from those being built within Canada itself, several processing plants to be built on the American side of the border are intended to operate on Canadian crude.

Thus, 1953 marks the opening of a new chapter in Canadian oil development, the nation's emergence as an important factor in the international field leading to a growth in economic power and industrial greatness that can be measured only by the imagination.

Saskatchewan's oil and gas policies

By Hon. J. H. Brockelbank

NATURALLY, OUR GOVERNMENT is deeply interested in as full a development of our oil and natural gas resources as possible. At the same time, we believe it is only right that these resources should be developed in such a way as to benefit the people of our province to the fullest extent possible.

Keeping these two objectives in mind, and seeking to balance them fairly, as we believe we have, the Saskatchewan Provincial Government during the past several years has followed a policy aimed at protecting the public interest by framing and enacting conservation laws assuring the best utilization of oil and natural gas, and at the same time encouraging further rapid exploration.

Seismic crew surveyor wears Navy-type mask to protect against windburn during winter reconnaissance work in the Saskatchewan section of the Williston basin. All photographs except those of the Hon. Mr. Brockelbank and his assistant are reproduced through the courtesy of Socony-Vacuum Oil Company.

Hon. J. H. Brockelbank, Saskatchewan's minister of natural resources.

It has been our policy in the past, and will continue to be the policy of the new Department of Mineral Resources, to discuss matters affecting the oil industry with their representatives before putting changes into effect.

Mineral rights for the disposition of oil and natural gas have gradually emerged into two general phases: those lands which are now under the regulations of 1945, and as subsequently amended, and those lands under a new set of regulations which became effective on June 8, 1951.

The regulations of 1945 have been supplemented by special agreements and extension agreements. A special agreement calls for the posting of a rental in advance, 90 percent of which is refundable. For the most part, the rental involved is 30 cents per acre the first year and 40 cents per acre the second year. Under the extension agreement, the rental is 60 cents per acre, with 85 percent of it refundable. The refundable portions in both instances, with slight qualifications, are earnable by drilling.

Regulations which came into effect June 8, 1951 cover our standard method of disposition at the present time, and develop two phases: a permit stage of three years, and a lease phase of 21 years. The new regulations were formulated with the cooperation of many representatives of the oil industry in Saskatchewan. They provide for the earning of Crown rights on a competitive bid basis.

J. W. Churchman, deputy minister of natural resources.

The land that is out under the disposition of the old regulations and special agreement provided for a 25 percent Crown reserve which was established on a checker-board system before the permits were let out. Under the new regulations, the Crown reserve is not established until the permit holder elects to go to lease. Crown reserves will vary 40 and 60 percent under the new regulations, depending upon the size of the initial block that the company elects to select within any township.

As the result of the intensified search for oil in Saskatchewan, most of the indicated natural gas fields are in the process of being proved. Today, great emphasis is being placed on the development of our natural gas, and those engaged in this work are being given every encouragement through our recently announced gas export policy.

The Provincial Government will allow the export of natural gas should any interprovincial pipeline, to the satisfaction of the Government, guarantee for the duration of its life supplies of natural gas at reasonable rates, sufficient to meet the provincial requirements of the province, and at the same time assure an adequate share of the export market for natural gas produced in Saskatchewan.

There are two other conditions under which the export of natural gas will be allowed if the above guarantees are not obtained. It will be allowed after the establishment of a proved reserve for provincial use of one trillion cubic feet, such provincial reserve to be increased by 50 percent of reserves proven over one trillion cubic feet, and 25 percent of reserves proved over three trillion cubic feet, with the exportable portion being available from all reserves.

The province will reserve the right to restrict the export, in the event that the provincial reserve will be reduced by such export, or at any time it is determined that the production allowable for any one year does not meet the provincial demand.

Engineering and market studies have been made by competent authorities which estimate that a reserve of between 700 and 800 billion cubic feet would be sufficient to meet the foreseeable requirements of the province for a period of 20 years.

Insofar as oil is concerned, because of the limitations of concentrated population and industry in Saskatchewan, it naturally follows that the great markets for oil resources will not be within our own boundaries. Outside markets must be found. As a result of this situation, no restrictions prevail, or are anticipated, with respect to the matter of export of Saskatchewan crude oil.

Export of oil will undoubtedly involve great capital outlays in the construction of oil pipe lines, etc., which in turn will require the proving up of a large volume of oil before the necessary transportation facilities can be built to accommodate and facilitate the business of getting the crude to market.

To date, the Provincial Government is considering, but has not formally developed, a policy with respect to the disposition of Crown reserves, as established under their regulations.

An impressive record of new discoveries and development was made by the oil industry in Saskatchewan in 1952. Crude output increased 35 percent, natural gas utilization was expanded, and light and medium oil was found in the Canadian portion of the Williston basin. The industry invested $31 million in the province and now is spending at the rate of about a million dollars per week.

In reviewing the expanded drilling activity that took place in the Saskatchewan petroleum industry last year, one cannot help but be amazed at the efficient manner in which the oil companies operating in this province carried out their work projects.

Not only were very important oil finds made, but as the result of drilling for oil, for the first time in its history, the Government was able to distribute Saskatchewan natural gas to two communities. This set the stage for the beginning of an integrated plan to serve natural gas to as many provincial centers as possible in the shortest possible time.

One of the important developments during 1952 was the formation of the Saskatchewan Oil and Gas Conservation Board which was set up to assist in the administration of the province's oil industry. Under the chairmanship of C. A. L. Hogg, Deputy Minister of Natural Resources, the board has two other members, Dr. J. W. T. Spinks, Dean of the College of Graduate Studies, and Prof. F. H. Edmunds, professor of geology at the University of Saskatchewan.

The board is not responsible for day-to-day administration of the oil and gas conservation act, but investigates and advises on specific problems related to conservation and is empowered to take evidence under oath.

Also during 1952, study began on the formation of new regulations under the Oil and Gas Conservation Act. They were finalized in February 1953, and cover many phases of the industry, including drilling, production, safety measures, and plugging and abandoning wells. The new regulations were prepared by the Department of Natural Resources with the cooperation and help of representatives of the oil exploration and development industry in Saskatchewan. The same procedure was used in preparing the oil and gas conservation act.

As a result of this procedure, we can rest assured that not only have we one of the best oil and gas conservation acts in effect on the continent, but we have also a set of the best regulations for the direction and guidance of the department and the industry in the conservation and production of oil and gas in Saskatchewan. We are indebted to the representatives of the industry for the time and effort they have put into the work with us.

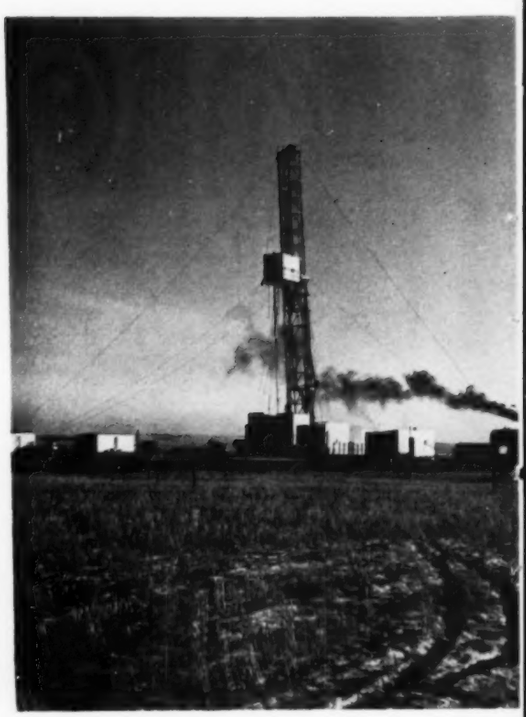
Some impressive records were made in 1952 insofar as production figures were concerned in Saskatchewan. Oil production for the year totalled 1,696,288 barrels, or showed roughly an increase of 35 percent over the previous year's figure. In 1951, production was just over 1,000,000 barrels.

Not only was crude produced from Lloydminster, Lone Rock, Dina, Maidstone and Coleville, as was the case at the end of 1951, but new fields went on production near Fosterton, Hoosier, Wapella, Eastend and Driver-Eureka.

In the natural gas picture, total production for 1952 was 1,138,641 mcf compared to only 860,082 mcf in 1951. The Unity wells were the largest producers last year followed by those at Lloydminster, Coleville, Lone Rock, Kamsack and Brock. Coleville and Brock were new producing areas. It is expected that with increased markets for natural gas during 1953, new production records are bound to be established next year.

In the latter part of 1952, the Oil & Gas Conservation Board considered that in the Viking horizon of the Brock-Coleville area there were established natural gas reserves amounting to not less than 200 billion cubic feet. The board held a hearing at which it received submissions on gas reserves. Following the board's decision, application was made by the Saskatchewan Power Corporation to construct a natural gas pipeline to the city of Saskatoon. Present plans call for an official opening of the line in the fall of 1953, thus making Saskatoon the first city in the province to receive the benefits of this utility.

Last year 25 wildcat discoveries were made in Saskatchewan, while a total of



214 were drilled. During the peak month of drilling activity, 40 rigs were in the field. A total of 282 development wells were drilled, and of that number 54 were abandoned as dry holes and 228 were completed as potential producers. Altogether 536 drilling licenses were issued by the department, three of which were cancelled.

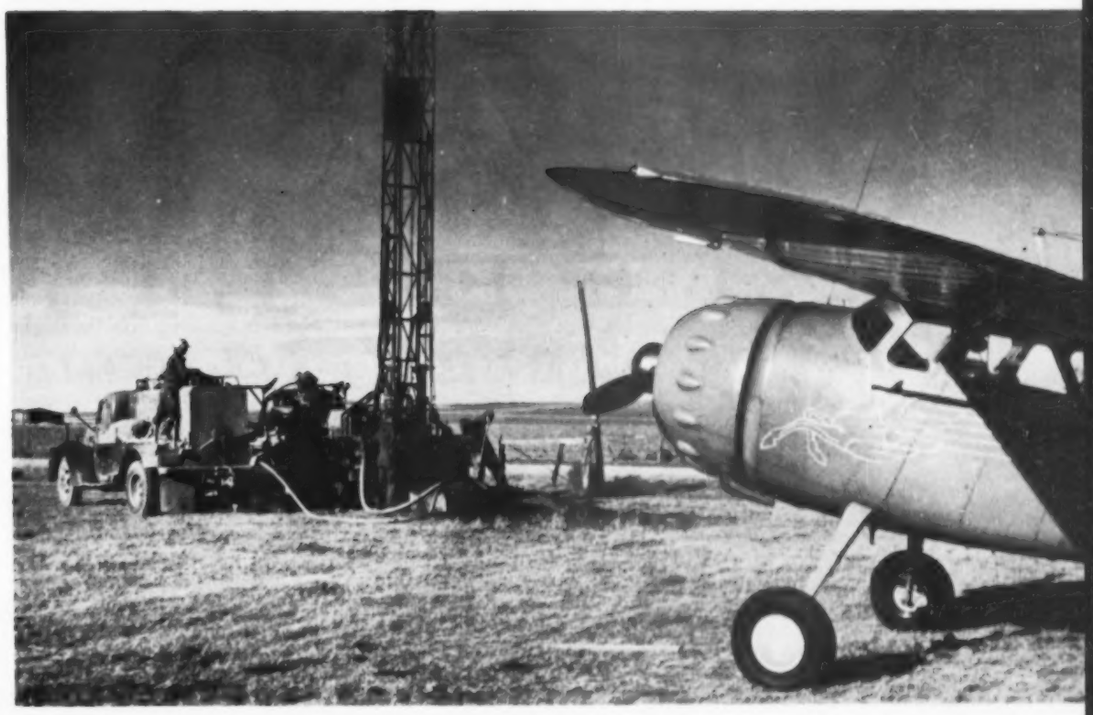
Geophysical companies working in the province had a record number of 52 crews in the field during the height of summer operation. During the year, 37 geophysical licenses were issued covering 55 parties, two of which were operating in the Precambrian.

There is no doubt that the year 1952 will go down in oil history as the year of the medium oil discoveries in Saskatchewan. When the New Year was only three days old, Socony Vacuum Exploration Company announced the discovery of a free-flowing well near Fosterton. Initial tests indicated that Socony Western Prairie Fosterton No. 1 yielded 24° gravity oil at the rate of some 300 barrels per day. The oil contained very little natural gas, and at that time was described as the best strike in the province's history.

Before the year was out, the outer boundaries of the Fosterton field were located, and extensive drilling operations at nearby Cantuar, Success, Beverly and Midway resulted in further important medium strikes. As the direct result of finding substantial commercial quantities of oil in these districts, it was announced by Socony Vacuum officials at the year's end that the company plans to construct a 175-mile pipeline to Regina. Actual con-

Fosterton, Sask., railroad station where Socony-Vacuum discovered the first medium-gravity oil in commercial quantities in Saskatchewan.

Jack-knife rig of the type used in drilling to the moderate depths at which production is found in the Fosterton area. ←



→ *Socony-Vacuum plane visits one of the company's seismic shot hole crews on the plains of Saskatchewan.*

struction is to begin as soon as the company is assured of a production of at least 10,000 barrels of crude per day.

Another commercial medium oil field was discovered by the Tide Water Associated Oil Company near Eastend in southwestern Saskatchewan during September. The discovery well, Tide Water Eastend Crown No. 1, gave an indicated production of 23° gravity crude of about 34 barrels per hour. Since that time, other successful wells have been drilled in the area.

The last medium oil find announced in 1952 which led to development of a field was an Imperial-Tide Water venture near Wapella, in mid-October. Since the discovery well was completed other step-outs have been completed. Drilling is being carried on now by Imperial Oil Limited, Tide Water and Sohio Petroleum. The wells are located near the town of Wapella, which is situated in a healthy grain and mixed farming district. They average a production of 75 to 95 barrels of 25 to 27 gravity crude per day.

In all, six medium oil areas, including Fosterton, Cantuar, Success, Midway, Eastend and Wapella, boasted approximately 40 wells capable of production at the end of 1952.

Drilling in northwestern Saskatchewan showed no signs of decreasing during 1952. Statistics show that in January there were 188 wells producing crude in the Lloydminster, Lone Rock and Maidstone area. Eleven months later the number of producers had risen to 268, plus 50 wells completed but not yet on production.

For the first time there were real indications in 1952 of finding valuable discoveries of light oil in Saskatchewan. In March, it was announced there were favorable drill stem test recoveries of 33° gravity oil from Canada Southern Driver No. 4, near Coleville. Production tests were made from the Viking sand in a 22-foot pay zone, and it was found that the well could also produce natural gas from another level of the Viking. Three step-outs were drilled and all were capped as potential natural gas wells.

The first producing light oil well in the province was spudded near Ratcliffe in April and completed in June. The discovery, Socony Vacuum Ratcliffe No. 1, is located four and one-half miles north of the international boundary in the southern Saskatchewan portion of the Williston basin. The crude found there contained a mixture of natural gas and salt water. However, after passing through a separator and a treater, there was a favorable production of 31° gravity oil. Production during an extended test was taken to the Imperial Refinery in Regina. Another well was spudded nearby in the early part of 1953.

Although not announced as a light oil discovery until early 1953, Tide Water Associated spudded a well in the Forget district, about 65 miles northeast of Ratcliffe, during the latter part of the year. In January of this year, oil was discovered in the well having a gravity of 29.5 degrees and an initial production of over 100 barrels per hour.

Among the heavy crude strikes made during the year were those of the Anglo-American Exploration Company near Gull Lake, Husky-Phillips ventures at Hoosier, Buffalo Coulee and Onward wells by Canada Southern Oils Ltd., and Eagle Hills by Allenbee Peak and Associates.

The five leading oil companies holding permits to explore for oil and natural gas in December 1952, were Socony-Vacuum Exploration Company, Tide Water Associated Oil Company, Shell Oil Company, Albercan Oil Corporation and Hudson's Bay Oil. The five companies holding the highest number of leases were Husky Oil and Refining Limited and Phillips Petroleum Company, Bata Petroleums Ltd., the Albercan Oil Corporation, the Socony Vacuum Exploration Company, and Franco Oils Ltd.

A permit issued by the Department gives the holder an opportunity to carry on extensive exploration work. The limit and size of a permit is 100,000 acres over a non-renewable period of three years. If a discovery is made, a lease may be granted the company, and drilling must be started within six months. Cancellation may be made for failure to comply with drilling commitments.

A conservative estimate of $50 million has been set as the expenditure for oil and natural gas exploration in Saskatchewan during 1953. The amount spent in 1952 was around $31 million and it was estimated $20 million was spent in 1951. Although it seemed to take a considerable time to get extensive exploration programs underway, prospects for the future of this province in the Canadian oil industry never looked better.

PIPE LINES

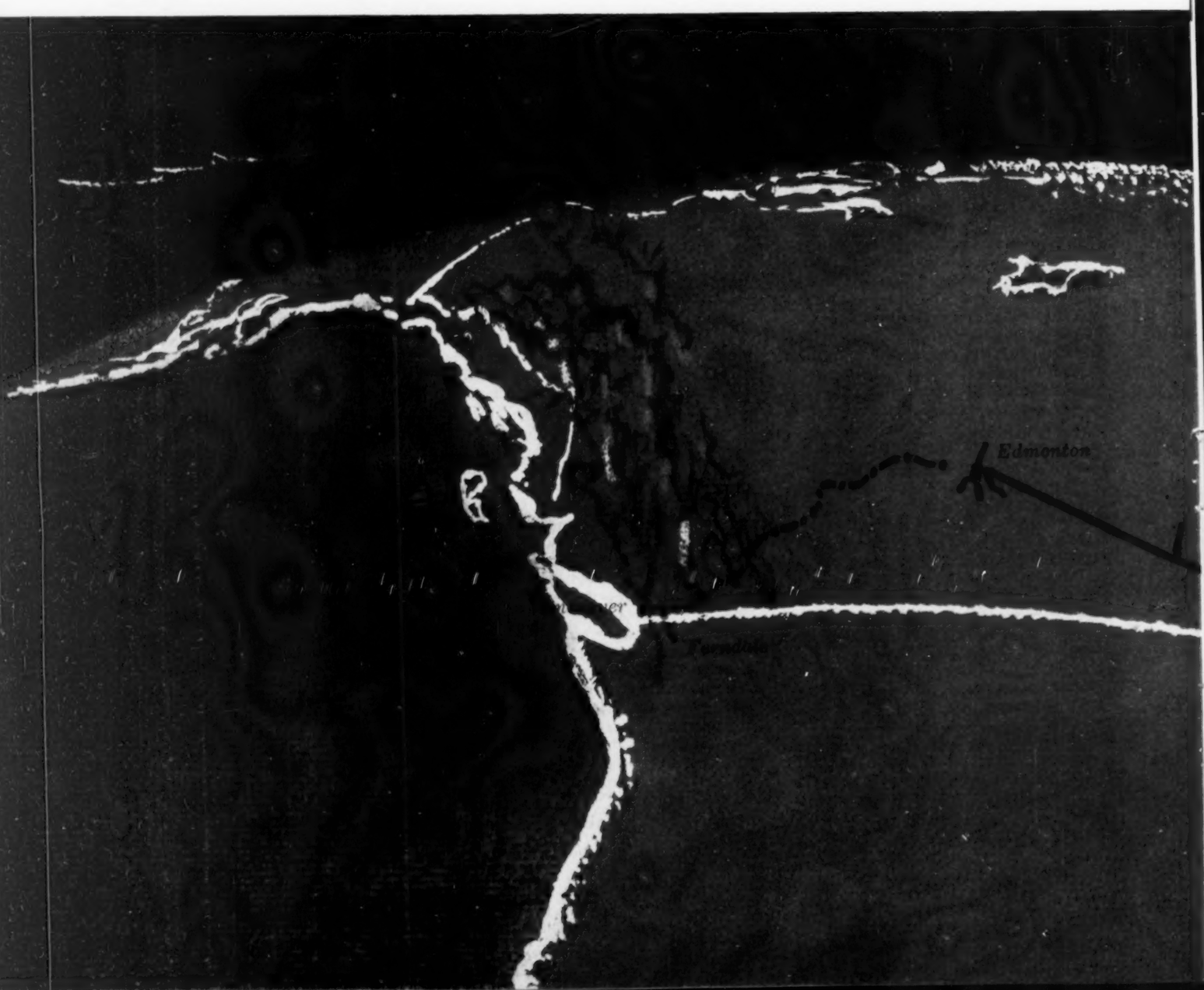
4,000 miles of pipe line to span Canada before the end of 1953

Operating crude lines.

Operating product lines.

Building crude lines.

Building product lines.



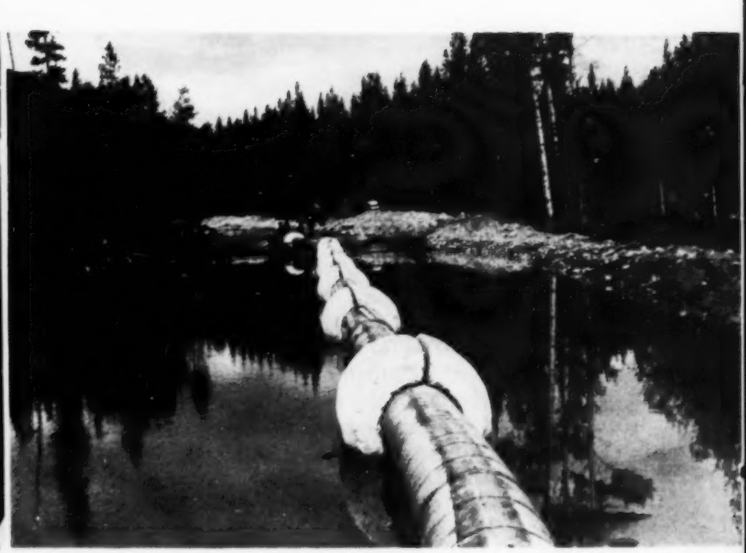
CANADA WILL INCREASE its investment in trunk pipe line systems $183.5 million in 1953. At the close of the year, total crude oil and product mileage exclusive of gathering facilities probably will total about 4,000 miles. Some gas line development is under way but major lines still are in the planning stage.

Two major crude lines to be completed this year are the 718-mile Trans Mountain line from Edmonton, Alberta, to British Columbia and the 635-mile extension of the Interprovincial system from Superior, Minn., to Sarnia, Ont. Completion of these lines will give outlets for Prairie crude about equal to the present producing potential and will provide a basis for expansion of western crude output to meet the growing needs of Canada and to supply U. S. refineries in the Pacific Northwest, northern Minnesota and Michigan.

Both new pipe line systems will begin operating at less than their potential capacity. The Interprovincial extension will begin delivering about 28 per cent of ultimate. When future demand warrants the installation of added pumping facilities, the two lines will be able to move 600,000 b/d of oil from the prairie provinces. Trans Mountain can pump 300,000 b/d across the Rocky Mountains to the west and the Interprovincial extension can deliver 300,00 b/d to the Sarnia region.

Ultimate capacity of the Interprovincial extension is approximately twice the present demand for petroleum

Follow-up welder on Trans Mountain line near Red Pass, B. C. All Trans-Mountain line photographs are by Richard Finnie for Bechtel.



Concrete weights applied to the Trans Mountain line at approach to No. 4 crossing of the Fraser River west of Jasper.

products in Ontario. The line may serve a group of refineries in Michigan as it now does in Wisconsin. This would serve to build the line load more quickly than normal demand growth which recently has been at the rate of 100 percent in six years.

British Columbia consumed about 54,100 b/d of oil in 1952, a little more than a quarter of the Trans Mountain's ultimate capacity. There is, however, a very large demand in the Portland-Seattle area in the United States, about three times that in British Columbia. Refinery construction in the state of Washington is expected to be stimulated by the availability of Alberta crude. General Petroleum Corp. now is building a 35,000-barrel plant which will begin taking its raw material from Trans Mountain in 1954.

Completion of the $92 million, 718-mile, 24-inch Trans Mountain Oil Pipe Line this coming August (starting to deliver western Canadian crude oil to the Pacific Coast during October) will be a milestone in the development of the Canadian oil industry.

Ever since the current large-scale development of the western Canadian oil fields, production has been restricted by the lack of sufficient transportation. The importance of economical transportation can clearly be appreciated when one realizes that two-thirds of the Canadian market (eastern area) is some 2,000 miles removed from the oil fields and the western market is over 700 miles away.

Although proven reserves have increased from 46 million barrels in 1946 to almost 2,000 million barrels (more than 40 times), and more than $1,000 million has been expended in the exploration and development of the Canadian oil industry, production has increased less than nine times to 165,000 b/d during 1952. Extension of the 1,130-mile Interprovincial pipe line and construction of Trans Mountain will remove the transportation bottleneck and permit greater exploitation of Canadian reserves.

The original Trans Mountain plans were for two pumping stations which would have provided for an initial capacity of 75,000 barrels of crude oil per day. In July last year a third pumping station was planned to boost initial capacity to 120,000 b/d. A more recent review has caused authorization of a fourth station to increase line capacity to 150,000 b/d by July 1954. A total of 14 stations will be necessary to reach the ultimate line capacity of 300,000 b/d.

To supply a new refinery to be built at Ferndale, Washington, plans for the construction of a 30-mile spur line recently were announced. This will connect with the main pipe line at Sumas, British Columbia. The spur, which will cost approximately $2,750,000, will be completed during the summer of 1954 so as to be ready by the time the new refinery, being constructed by General Petroleum Corp., goes into operation in the fall of 1954.

As far back as December, 1950, Bechtel and oil company executives and engineers began studying various roads between Alberta and Vancouver. Both by airplane and train they crossed and recrossed the Rockies, traversing the main passes. After the route was selected, photographic flights were made until every mile of terrain along the route had been photographed. Engineers then followed the tentative route on foot to select the best location in detail.

The route runs from the vicinity of Edmonton westward to Jasper National Park and through the Yellowhead Pass in the Canadian Rockies at an elevation of approximately 3,720 feet. It crosses into British Columbia, following the North Thompson River southward to Kamloops, when it turns southwest over a 4,000-foot plateau to a point near Merritt. From there it follows the Coldwater River, crosses the Cascade Range at 3,700 feet, drops down the Coquihalla Canyon to Hope, and finally swings through the last 90 miles down the Fraser Valley just north of the international boundary to Burnaby, adjacent to Vancouver.

Because of the terrain and the weather to be encountered, the construction program had to be broken into two seasons.

The first started in February 1952, with the obtaining and clearing of right-of-way, and lasted until early December. During this first construction season, there were five pipe line gangs in action. When operations were curtailed, 45 percent of the project had been completed and 329 miles of the pipe line had been laid, including 50 river crossings and 24 railroad crossings.

Between seasons, engineering and planning continued. Clearing and grading crews prepared right-of-way for spring pipe-laying wherever possible. Various stretches infringing on the highways and the last two major river crossings were put in. Due to the very mild winter in western Canada, pipe-laying was resumed earlier than anticipated.

Two spreads started early in March, and by the end of the month more than one mile of pipe was being welded daily.

The second construction season's program provides for six spreads. Two of these are being operated by Mannix Ltd. of Calgary. Mannix kicked off early in March east and west of Kamloops. Three spreads are being run by Comstock-Midwestern Ltd. of Toronto. Two of these started work along highways and railroads. The third will go into action in June, working up the North Thompson River from Blue River. The sixth spread is being operated this year by Anderson

Buck mule deer relaxing on the right-of-way of Trans Mountain pipe line in Jasper Park, Alberta.

Right bank of Fraser river was dozed down 100 feet to prepare for pipe line crossing east of Red Pass, B. C.

International Contractors Ltd. of Edmonton. This group started in the area west of Acheson during March. By the first of May it is estimated that about 375 miles of pipe will be laid, leaving 343 miles to be completed by August.

Anticipating that a considerable portion of the oil handled by Trans Mountain will be sent to offshore points, Trans Mountain is building a marine loading terminal in Vancouver Harbor. This initially will be staffed to handle as many as three tankers per week. The handling of five tankers per week will require only a few additional tankers.

The Trans Mountain right-of-way is 60 feet wide and wherever possible a 50-foot strip is cleared and graded. All felled timber and other damage is valued by registered appraisers and individual landowners are compensated.

Along the route freight cars, loaded with pipe joints 32 to 40 feet in length weighing about a ton apiece, have been spotted at about 140 sidings. The pipe is 24 inches in diameter and comes in seven thicknesses, from ¼ to ½-inch. The various sizes are used in different locations according to the pressures they will have to withstand. This pipe is the largest yet used for a major line in Canada.

To deliver pipe from stockpiles, hundreds of temporary access trails have had to be opened up and often existing rural roads have to be improved.

The pipe line ditch has been dug 44 inches wide and deep enough so that after pipe has been lowered and buried, there generally will be 30 inches cover over the line. Although the line runs through rugged terrain for many miles, less than five percent is in rock having to be dynamited. The entire pipe line is being buried. In agricultural areas the pipe is being buried so that the top is 30 inches below the ground. In rocky areas it is 24 inches below.

The pipe line is being buried eight feet or more below the beds of approximately 72 rivers, streams and creeks which are crossed. Only 20 of these crossings were considered major jobs and they all have been completed.

The outstanding individual crossing was completed early in April near the mouth of the Fraser River at Port Mann, British Columbia. The total length was 5,700 feet, including the approaches. The cross- is 24 inches in diameter and comes in ing was made in shipping lanes where the 2,250-foot channel is used by deep-sea vessels, commercial fishing boats and tugs towing log booms. As investigations showed that the low water of winter (when the depth would be approximately 40 feet) would be the best time to handle the job, the pulling was scheduled for late winter. Although originally it was expected that five days would be required to pull the line, it was done in two.

So that the flow of crude oil can be shut off anywhere and at any time if necessary, valves are being installed at distances varying from 10 to 20 miles. These valves stand about nine feet high and are being welded directly into the pipe line. They weigh 9,000 pounds and the total installed cost is about $15,000 apiece.

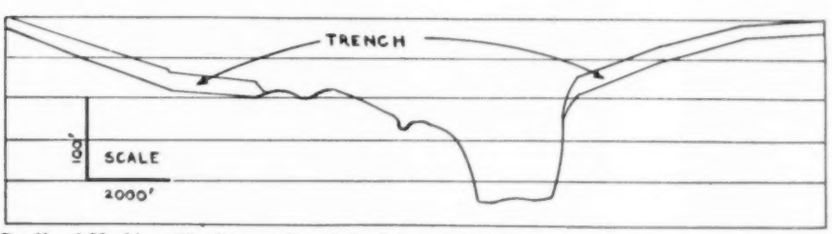
Two great tank farms are being built, one near Edmonton and the other at Burnaby outside of Vancouver. Each of these tank farms will have sufficient capacity to store initially in excess of one million barrels of crude oil.

Before cold weather curtailed exterior construction, work had advanced so far on three pumping stations that engines and pumps could be set and interior piping and electrical equipment could be installed during the winter. These initial three stations, which will be completed this summer, are located at or near Edmonton and Edson, Alberta, and Kamloops, British Columbia. The fourth station will be constructed at Black Pool, British Columbia. Toronto Iron Works Ltd. is building crude oil storage tanks at the Edmonton terminal which will have an aggregate capacity of 1,531,920 barrels.

From the tank farm near Vancouver, connecting pipe lines are being constructed to the two nearby refineries in the Vancouver area and the new Trans Mountain marine loading terminal on Vancouver Harbor.

Approximately 2,600,000 barrels of crude oil will be required to fill the pipe line and supply adequate operating reserves at both tank farms.

At current prices the value of this oil filling the line and the operating reserves



Profile of Mackinac Straits crossing of the Interprovincial extension to Sarnia, vertical scale greatly exaggerated to show complexities of the 4½-mile crossing with 235-foot glacial gorge.

will be in excess of $6,000,000. When working at capacity, it is estimated that about $450,000 worth of crude oil will pass through the pipe line every day.

In anticipation of the start of actual operations, a permanent operating organization is being brought together in Vancouver and trained under the leadership of H. H. Anderson, vice president and general manager of Trans Mountain.

The principal oil companies participating in Trans Mountain are: Canadian Gulf Oil Co., Imperial Oil Ltd., Shell Oil Co. of Canada Ltd., Standard Oil Co. of British Columbia Ltd., and Richfield Oil Corp.

Throughout the entire development and construction period, the program in behalf of Trans Mountain has been coordinated by Canadian Bechtel Ltd. acting as agent for the company.

The new 30-inch extension of Interprovincial will cross Wisconsin, the upper peninsula of Michigan, the straits of Mackinac, and extend southeastward across Michigan to Port Huron where it will cross the St. Clair river to Sarnia. The route selected was found to be shorter and less costly than any Canadian route. Because of the routing, the extension will be built and operated by a wholly-owned subsidiary, Lakehead Pipe Line Co., Inc., the U. S. corporation which now operates the 324-mile section of Interprovincial from the Canadian line to Superior, Wis.

Construction of the line involves one difficult and interesting engineering problem, the crossing of the Straits of Mackinac. At the point selected for the crossing, the straits are 4½ miles wide. The slope for three miles is gradual but in the center is a 245-foot glacial under-water gorge with steep rocky sides and bottom. The gentle shore slopes are not without problems also. In winter, drift-ice piles up along the shores and creates an abrasive condition on bottom. It has been decided to bury the line 15 feet below the bottom of the Straits near the shore to avoid winter mishaps. The line also will have to be securely anchored.

Only one pumping station will be required at the outset to deliver 84,000 b/d of crude to Sarnia. Five others will be required when the line reaches 300,000 b/d delivery capacity.

When Interprovincial was built in 1950, two years after the Leduc discovery, no one visualized the great potential of the Prairie provinces. At that time it would have been foolhardy to have made the line a "big inch." On the basis of what was known at that time, 20- and 18-inch pipe was laid part of the way to supply Saskatchewan refineries. The remainder of the line was constructed of 16-inch pipe.

In 1951 the line delivered 35,500 b/d of crude at Superior. In 1952 additional storage was erected at the terminal, five new pump stations were built, and 100 miles of 16-inch loop was laid to increase the capacity. Deliveries of crude at Superior were stepped up to 58,621 b/d.

This year the line looping is to be extended with 135 miles of 24-inch pipe eastward from Regina. Additional horsepower will be installed at existing pumping stations.

When the 1953 construction program is complete, Interprovincial will have a capacity of 155,000 b/d eastward from Edmonton. Prairie province refinery customers will take about 40,000-50,000 b/d, leaving more than 100,000 b/d for delivery to the east. Local plants at Superior are expected to require about 15,000 b/d. Lake Superior Refining Co. will take about 5,000 b/d and International Refineries at Wrenshall, Minn. will need 10,000 b/d. This is a new plant just now being completed. British American Oil Co. will continue to pick up about 10,000 b/d of crude by tanker at Superior since the new Sarnia extension will not go as far east as Clarkson, Ont. As mentioned previously, Sarnia deliveries to Canadian Oil Companies Ltd. and Imperial Oil Ltd. will approximate 84,000 b/d when the line begins pumping next December.

Total cost of the Lakehead extension and the Interprovincial looping will be about $86 million. Of this, $12 million will be for looping and $74 million for the 30-inch extension. It will require eight million barrels of oil to fill the line, as much crude as Alberta now produces in a month and a half.

Interprovincial is financing the Sarnia extension through the sale of bonds and of common stock. All stockholders were offered common shares at $18 per share at the rate of two shares for every five already held.

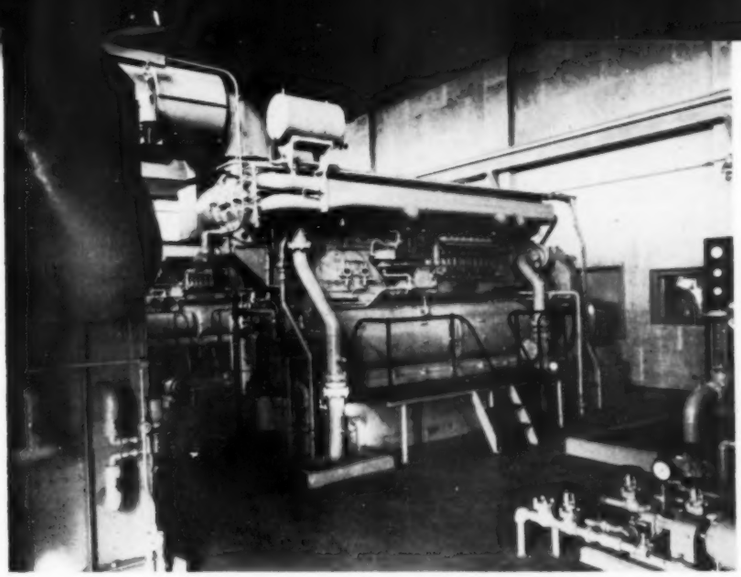
This and the public sale netted the company about $25.7 million. In addition, institutional investors were offered $60 million in four percent mortgage bonds.

When the financing is completed, Interprovincial will have an outstanding common stock of 5,038,432 shares. Bonded indebtedness will be $132 million.

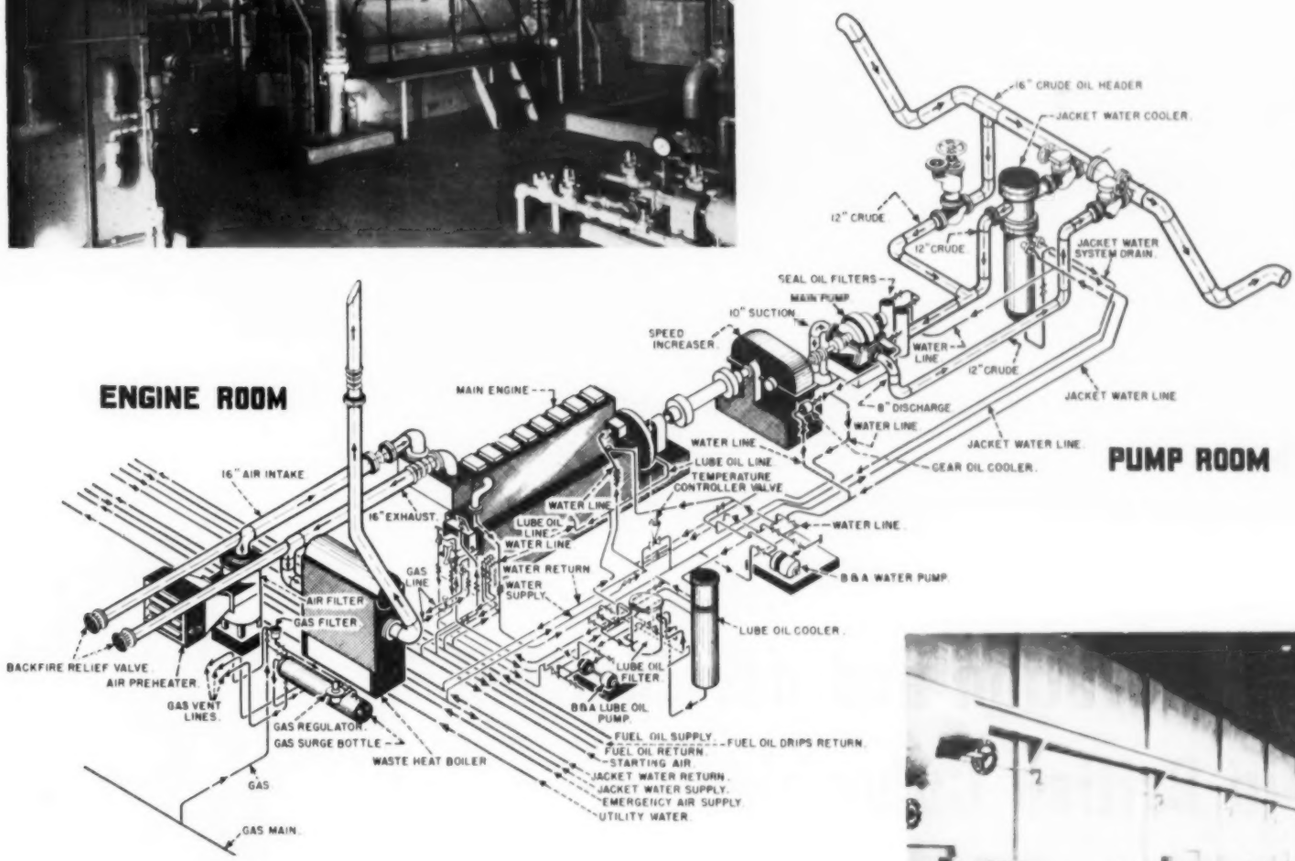
In 1952 Interprovincial transported 41,215,348 barrels of oil through at least a part of the system, an average of 112,600 b/d. Deliveries to Superior, Wis., for tanker movement eastward averaged 55,-

(Please turn to page 160)

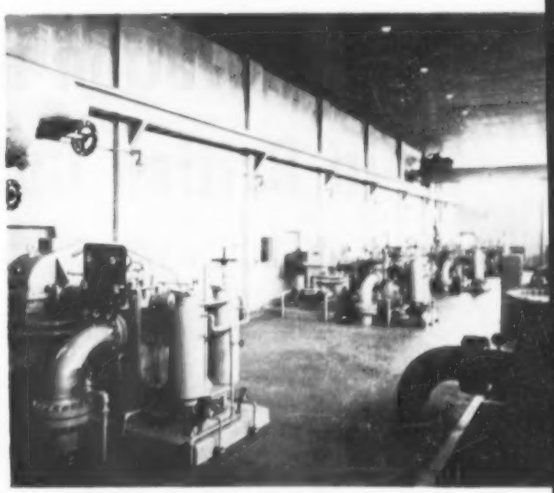
Hamilton Bay crossing constructed as part of Imperial's 188-mile products line from Sarnia to Toronto. Thirty-foot lengths of pipe were welded into 1,200-foot strings and towed into position on pontoons spaced 200 feet apart. Left, poling pontoons into position. Right, attaching pipe strings to pontoons at water's edge.



Left, supercharged Dominion Alco diesel with waste heat boiler at Interprovincial station.



Above, diagram of engine and pump rooms at Interprovincial station, courtesy Dominion Engineering Co. Ltd.



Above, general view of pump room at Interprovincial station showing speed increasers, pumps, 10-inch pump suction line, seal oil filters and 12-inch crude suction line from jacket water cooler to low pressure pump.

Left, aerial view of Edmonton pump station.

Two geologists on Jackfish Mountain wait to be picked up by helicopter. Take-off at this point was over a sheer cliff. Pilot had to hop his craft to the edge and give a final burst of power to carry it into space. All photographs with this article are reproduced through the courtesy of Imperial Oil Ltd.

Exploration and development in British Columbia

By John D. Lineham

FIRST PERMITS for petroleum and natural gas exploration in British Columbia were issued in November 1947. For the next four years, although a few wells were drilled, mainly in the Peace River district, exploration was limited largely to geologic surveys in the more accessible parts of that area.

Other sections that received some attention include the Flathead area in the southeastern corner of the province, Queen Charlotte Islands, the Cariboo district immediately south of Quesnel, and the lower mainland area near Vancouver and New Westminster.

Beginning in November 1951, the demand for leases increased rapidly as the result of Pacific Petroleums Ltd.'s first well in the Fort St. John area which gave good shows of both oil and gas. At the end of 1952, a total of 36,193,672 acres were held by 69 companies and 123 individuals under 572 permits and 139 licenses. Ninety-one percent of this acreage is situated in the Peace River district.

During 1952, all types of exploration increased considerably and it would appear from the program proposed for this year that investigation will continue at an even greater rate during the remaining months of 1953.

Since 1947, 47 wells have been drilled in the Peace River district, of which 20 have been completed as potential gas wells, 26 have been abandoned and one is suspended for the winter months. In addition, nine wells are now drilling. Eleven wells were drilled during the same period in other parts of the province, all of which have been abandoned. Of the 29 wells operated during 1952, 11 were completed as gas wells, 13 were drilling or suspended and five were abandoned.

Ownership of petroleum and natural gas rights in British Columbia is similar to that in other western Canadian provinces insofar as the majority of the rights have been reserved to the Crown in the right of the province.

Specifically, no Crown grant issued for land, the title to which was acquired after March 27, 1899, conveyed any right to petroleum. Subsequently, from March 1, 1913, the grants excluded the right to natural gas. Therefore, the ownership of petroleum and natural gas rights comes under one of three categories:

(1) Both the petroleum and natural gas are owned privately.

(2) The petroleum rights are vested in

John D. Lineham, Assistant Petroleum Controller, Petroleum and Natural Gas Division, Department of Lands and Forests, Government of British Columbia, received his primary education in Okotoks, Alberta, followed by one year at the University of Oklahoma. He then roughnecked for a year in the Turner Valley field and spent approximately two years with Trinidad Leaseholds Ltd. in Trinidad, B.W.I. Serving in the Royal Canadian Navy, he was discharged as a Lieutenant at the end of the war. He graduated from the University of Oklahoma in petroleum engineering in January 1948, after which he was employed by Royalite Oil Co. in Turner Valley and by Canadian Gulf Oil Co. in Pincher Creek until September 1948, when he accepted his present position.

Even the helicopter was of no use to geologists here. It was necessary to climb to the plateau above for a pick-up as the flying eggbeater could not land on the river bank below.

the Crown, but the natural gas rights are owned privately.

(3) Both the petroleum and natural gas rights are owned by the Crown.

It follows then, that in the more recently settled areas, such as the Peace River district, the government controls the so-called "oil rights," whereas in the older settled areas, such as the lower Fraser Valley, a large percentage of the rights are held by individuals.

Crown petroleum and natural gas rights are disposed of by permit, license or lease pursuant to the provisions of the Petroleum and Natural Gas Act. Briefly, the permit is for the purpose of conducting geological and geophysical exploration; the license is for the drilling of wells, and the lease is for commercial wells and for the development of proven fields.

A permit granting the applicant the sole right to explore for petroleum and natural gas within a described area may vary in size from 10,000 to 256,000 acres, provided that the length of the area does not exceed twice its width.

The initial term of the permit is for one year, for which the act requires payment of a $250 fee, and rental at the rate of $500 per 10,000 acres or part thereof. As most permits are in multiples of ten thousand, the first year rental is, in effect, five cents per acre.

A permit is renewable for two further terms of one year each upon payment of a fee similar to that of the first year and rental at the rate of ten cents and 20 cents per acre respectively. At the end of the third year, if the nature of the terrain, inaccessibility, or any other condition over which the permittee has no control has precluded the completion of the detailed investigation as set forth by the permittee, two additional renewals of six months each may be granted subject to special conditions. Therefore, although the normal duration of a permit is three years, the maximum period is for four years. Each of the fourth year renewals costs 20 cents per acre in addition to the usual fee.

Although the acquisition of land for speculative reasons cannot be prevented entirely, the Petroleum and Natural Gas Act is designed primarily to encourage exploration. One incentive toward that end is the possible refund of the first year's rental. In the event that the permittee conducts investigation work during the first year to the value of the rental paid, and provided a report by a registered geological engineer is submitted with an affidavit of expenditures, all or part of the rental is subject to refund. Also, if the permittee acquires a license within the limits of his permit and commences drilling during the first year, the refund is earned. This, in effect, allows an operator to explore for the first year for a fee of only $250.

Further, if during the second or subsequent years, the permittee has expended money for exploration work, he may, within 90 days after the completion of such work, make application for the establishment of a credit. This credit, which may not exceed 50 percent of the approved expenditures, may be used within a three year period for payment of rentals due on any location held by the person in whose name they were established.

Before geophysical work is conducted, the permittee must obtain a Geophysical Subsurface License for which he pays a $25 fee. In addition, a minimum deposit of $1,000 is required to guarantee the satisfactory performance of the obligations and the settlement of all claims for damage to private property. In the event that no claims are filed, the deposit is refunded in full.

A permittee has the sole right to apply for licenses within the boundaries of his permit.

A license grants the licensee the sole right to conduct exploration and drilling operations within the limits of the land described.

The license may vary in extent from 320 to 11,520 acres, providing the length of the area does not exceed twice the width. Therefore, the largest license available measures six miles by three miles. The initial cost of such a holding is a fee of $25 plus rental at the rate of 25 cents per acre. It is renewable, under the same terms, from year to year until the licensee has completed his drilling program.

Within six months of the issuance of a license, the operator is obligated to commence the first well, and subsequent to its completion or abandonment, a second well must be started, also within six months. However, it is possible to waive the drilling obligation after the first well is finished provided the licensee can give good cause for such consideration.

Up to 90 days after the completion of a drilling operation, the licensee may make application for the establishment of a

credit in an amount not exceeding 50 percent of the approved expenditures incurred. This credit may be used, as in the case of credits under permits, for payment of all or part of rent due in respect of any permit, license or lease held by the person in whose name it was established.

Before commencing a well, a drilling deposit of $2,500 is required to guarantee the satisfactory abandonment and restoration of the surface. This deposit is not refunded until the site on which the well was drilled is restored to the reasonable satisfaction of the landowner.

For the purposes of development, up to eight licenses may be grouped. Assuming that all were of maximum size and considering that one well may satisfy the drilling obligation for the entire group, it is possible to drill one well on 92,160 acres and at the same time fulfill the requirements of the Act.

The Petroleum and Natural Gas Branch must be supplied with continuous samples of the well cuttings, as well as those of all water, gas and oil encountered. In addition, copies of all daily drilling reports and full information concerning each well must be submitted. This accumulated information is treated as confidential for one year, or until the operator has terminated operations in the area concerned. The information is then available to the public. The same procedure applies to geological reports.

Upon discovery of petroleum or natural gas in commercial quantities, the licensee is required to lease within the area covered by a license or a group of licenses.

A lease confers upon a lessee the sole right to produce and develop petroleum or natural gas from a described location.

Subsequent to a commercial discovery, the operator may lease not more than 50 percent of the licensed area, the remaining portion being set aside as a Crown reserve.

The term of a lease is 21 years with an annual fee of $25 and rental at the rate of one dollar an acre per year.

The area under lease may vary in size from 160 to 5,760 acres, exactly half of that allowed under license. As is the case with permits and licenses, the length cannot exceed twice the width. It is renewable for a further term of 21 years or until such time as production is obtained or the operation has ceased.

In the case of a natural gas field which has been reasonably proven and delimited, the lease rental may be reduced to 50 cents per acre and if a market is not available, it may be further reduced to 25 cents per acre with the development requirements waived. Provision is made also for a natural gas lease as separate from a petroleum and natural gas lease.

The royalties payable to the Crown are 12½ percent on oil and 15 percent on gas on the gross value at the well head.

Any operator discovering a new field is entitled to a rebate of 25 percent of the approved expenditures incurred in drilling the discovery well. In such a case, 50 percent of the royalties payable to the government would be refunded until the rebate was paid. However, any credits established in respect of the discovery well would be reduced by an amount equivalent to the rebate.

When a well has determined the presence of oil or gas in commercial quantities, no credits are granted in respect of subsequent wells drilled within one mile of the discovery well.

The only petroleum and natural gas reserves within British Columbia at the present time include 16 square miles surrounding the site of a well drilled by the government in 1940-42 and a few areas that were formerly covered by permit which were not renewed by the holders.

Reserves may be established as follows:

(1) The Lieutenant-Governor in Council may, by a notice signed by the Minister of Lands and Forests, declare any area to be a reserve district, excepting areas already under permit, license or lease.

(2) When a license is converted into a lease, the equivalent acreage thus reverting to the Crown becomes a Crown reserve.

(3) Fractional areas that cannot be otherwise acquired under the provisions of the act become reserves.

Provision is made for the disposal of Crown reserves by sealed tender or public auction, after being adequately publicized.

In the case of areas reverting to the Crown as a result of leasing, the lessee in respect of whose license the reserve was created may within one week of the notice purchase the reserve for 90 percent of the acceptable bid.

The foregoing outline of the Petroleum and Natural Gas Act is essentially brief, but the main features and fundamental principles of the laws governing exploration for oil and gas in this province have been presented.

It is expected that exploration of the more favorable areas within British Columbia will continue with increasing intensity, particularly in the Peace River district. In the event that a gas line from that area to the Pacific Northwest becomes a reality, there will be an added incentive to carry the investigation to its logical conclusion.

Imperial geologists in a remote area of northeastern British Columbia prepare a geological map based on an air-photo map and ground reconnaissance.

Geophysical activity in Western Canada—1952

By M. J. Huffman

M. J. Huffman received his schooling in Alberta and Saskatchewan, then served 4½ years in the Canadian Army, returning from 3½ years overseas service in the artillery and infantry as a Lieutenant in the Calgary Highlanders. After 2½ years with the Alberta Petroleum and Natural Gas Conservation Board, he joined Imperial Oil Limited early in 1949, working in the Redwater field. Mr. Huffman joined the Scouting Department in September 1950, and was recently promoted to the position of assistant division scout.

IN LINE WITH all phases of the oil industry in Western Canada, geophysical activity reached new highs during 1952, with a total of 2,042 crew months of work being completed, an increase of 26 percent over the 1,624 crew months completed in 1951. Figure 1 shows graphically, in terms of crew months, the tremendous increase in geophysical exploration in Western Canada since 1947, when the discovery of the Leduc oil field started the current and still expanding Western Canada petroleum boom. An 877 percent increase is noted in activity over this six-year period. The number of geophysical crews located in Western Canada during this period increased from 23 at the close of 1947 to 151 at the end of 1951 and 180 on December 31, 1952.

Table I outlines the number of crew months of work completed by seismograph, gravimeter, and magnetometer parties in each of the provinces of Western Canada for the years 1947, 1951 and 1952. From these figures it can be seen that the crew months of work completed in 1952 by the reconnaissance tools, gravimeter and magnetometer, which account for only a very small portion of the total geophysical work accomplished, remained relatively constant, while crew months completed by seismic continued to increase by leaps and bounds, with 1952 seeing approximately 28 percent more seismic work than 1951.

While most of the seismic operations were still concentrated in Alberta, it is worthy to note the growth of seismic activity in Saskatchewan and British Columbia. Primarily responsible for the increase in Saskatchewan were several discoveries of commercial quantities of medium gravity crude and the work commitments required on crown permits.

Only 35 crew months of seismic work were completed in British Columbia in 1952, but this represented more than a 100 percent increase over 1951. This doubling in activity is largely the result of the discovery of gas and oil in the Fort St. John area of northeastern British Columbia in late 1951. As in Northern Alberta, problems of accessibility will result in much greater party costs as compared to the plains areas of southern and central Alberta and Saskatchewan.

In Alberta, prior to 1952, the region of greatest seismic concentration has been the "Fairway" area south of Edmonton, a very favorable Devonian reef country. In 1952 a shift was noted from this "Fairway" area westward to the deeper basin and foothills areas of Western Central Alberta. The discovery of several large

A broad expanse of muskeg in northern Alberta where reconnaissance work is limited to winter months. Imperial photo.

Devonian reef pools with gas and oil pay thicknesses ranging as high as 600 feet has been a prime factor in causing this new area of concentration, 30 seismic crews being active at one time in a relatively small area of approximately 50 by 10 miles.

One other interesting feature of the 1952 Alberta seismic program was the decline in the number of crews moving to Northern Alberta to start winter operations. This crew movement, which is necessary because of the muskeg conditions covering a great portion of Northern Alberta, usually begins at freeze-up time early in November. These reasons are advanced for this decrease in Northern Alberta activity:

(1) The abnormally late freeze-up occurring in Northern Alberta, which saw relatively little frost in the ground even as late as December.

(2) Many Crown reservations had been extensively covered by seismic during the past two winters, and have now reached the drilling stage.

(3) The lack of promising oil discoveries in Northern Alberta, in relation to the expensive nature of operations, coupled with the ever-increasing prospectiveness of Saskatchewan where operations are cheaper and easier.

There is every indication that geophysical activity in Western Canada in 1953 will easily surpass that of 1952. No major change in area activity is indicated as yet, but minor changes involve an increase in crews in Northeastern British Columbia, Saskatchewan, and the Edmonton area of Alberta, while decreases are noted in the Peace River area of Northern Alberta and in Southern Alberta. During January 1953, approximately 15 percent more geophysical work was completed than during January of 1952.

It is estimated that approximately $40 million was spent on geophysical exploration in Western Canada during 1952, while 1953 expenditures on this phase of exploratory activity should approach the $50 million mark. When it is considered that from $3 to $4 million was spent on geophysics in Western Canada in 1947, the terrific strides taken by industry in the use of geophysical instruments over the past six years may be realized.

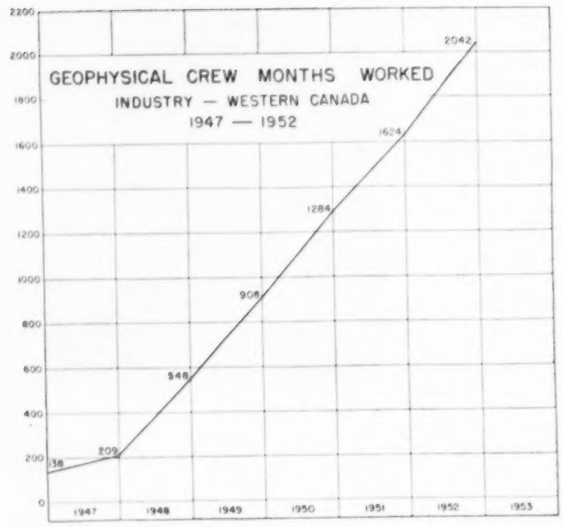


Figure 1: Chart prepared by the author.

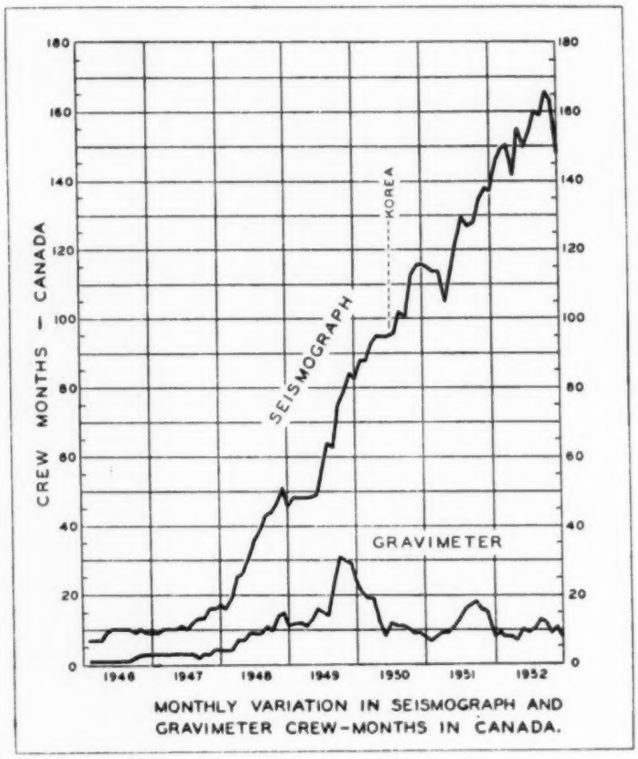


Figure 2: Chart from paper by E. A. Eckhardt, Gulf Research and Development Company, presented before annual meeting of Society of Exploration Geophysicists.

TABLE I

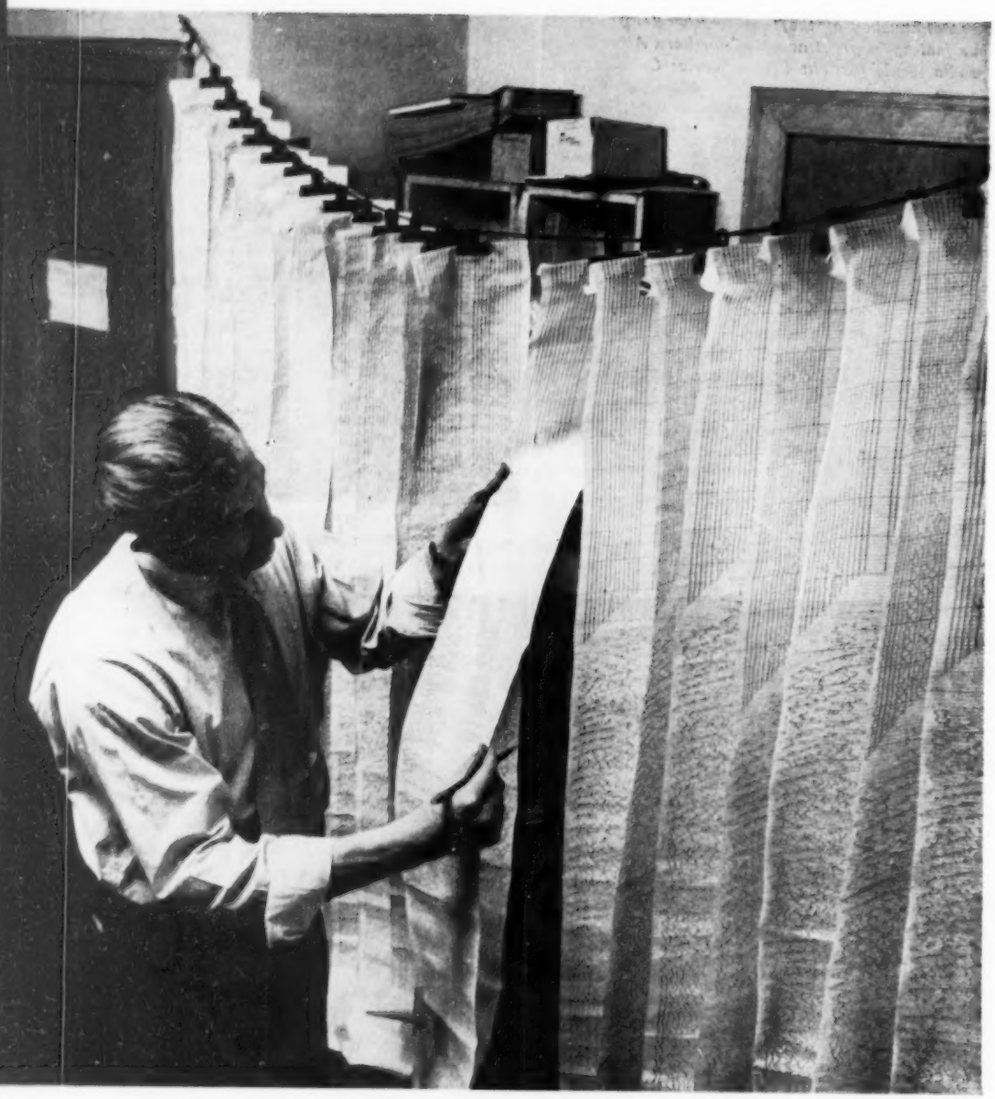
GEOPHYSICAL ACTIVITY CREW MONTHS, WESTERN CANADA

	Seismic			Gravity			Magnetometer			Total		
	1952	1951	1947	1952	1951	1947	1952	1951	1947	1952	1951	1947
Alberta	1,420	1,144	155	89	109	41	3	7	7	1,512	1,260	203
Saskatchewan	363	243	...	43	26	..	26	16	..	432	285	...
Manitoba	36	50	6	4	8	..	6	7	..	46	63	6
British Columbia	35	16	...	..	...	..	3	..	..	38	16	...
Northwest Territories	1	..	...	4	...	..	9	..	..	14	..	...
Total Western Canada	1,855	1,453	161	140	141	41	47	30	7	2,042	1,624	209

A piece of muskeg of the type which offers such precarious footing in great areas of northern Alberta. Photo by Fritz Henle for The Cities Service Company.

Surveyors working in the Peace River district of Alberta in advance of seismic crews. Imperial photos.

Well equipped camp trains are pulled across the frozen muskeg to serve as a base for seismic crews working in northern Alberta. Imperial photos.



Checking prints of a day's seismic records. Photo by Anthony Linck for Cities Service Company.

Manitoba: Williston Basin's Northeast Flank

By Noel M. Fowler

Noel M. Fowler is chief statistician for the investment firm of James Richardson & Sons, Winnipeg, Manitoba. Through the years, Mr. Fowler has devoted much attention to the development of the Western Canada oil industry and is considered an authoritative oil economist. He is responsible for the publication of the firm's internationally known booklet "Western Canadian Oils," now in the seventh edition.

Mr. Fowler was born in England and took some training in engineering in that country before moving to Canada in 1919. After graduating from the University of Manitoba, he carried on a research project under a grant from the Canadian National Research Council. He left academic research in 1928 to inaugurate the research and statistical services of James Richardson & Sons.

Mr. Fowler has done considerable speaking and writing on modern investment techniques and problems, and especially on Western Canadian oils.

THERE is no question that the southwest corner of the Province of Manitoba is entitled to be marked as a production area upon a North American petroleum map. Nevertheless, the significance of the discoveries at the time of writing probably lies more in the proof that another large segment of the Williston Basin is capable of commercial production than the actual volume of oil being produced.

Several wells were drilled in widely scattered areas in the southeast part of the province in 1950 and prior years. With the exception of some oil staining of cores in two wells put down near Lyleton in the extreme southwest, no real encouragement had been encountered. On November 16, 1950, the California Standard Co., Canadian operating subsidiary of Standard Oil Co. of Calif., spudded in its Cal-Stan Daly No. 15-18 in LSD 15-18-27-10 WPM and completed it as a pumper from the Mississippian limestone February 1, 1951, after taking the well down to the Precambrian at 5,350 feet (3,742 feet subsea). Oil men were quick to connect the discovery with that made some weeks later in the Amerada Petroleum Iverson No. 1 in Williams County, North Dakota. In 1951, in Manitoba, 17 wells were sunk while the score for 1952 was 72 wells.

Subsequent to completion of the Manitoba discovery well in February, 1951, exclusive of test drilling and holes abandoned at shallow depths because of mechanical or other difficulties, up to the end of February, 1953, a total of 87 wells have been sunk. Of this total, 42 wells produced oil in seven separate districts in the southwest corner of the province. During January 1953, 38 of these 42 wells were on production with a combined flow of approximately 1,400 barrels to bring the cumulative total for Manitoba to 162,056 barrels.

Thus far, the only Manitoba oil field is the Daly which is located in Township 10, Range 28, WPM, some 12 miles west of Virden, where 34 wells are working. Single wells are on production at Tilston some 26 miles south of the Daly, at Coulter and Waskada about 60 miles south of the Daly, and at Lulu Lake, roughly 70 miles to the southeast.

Upward of 75 Canadian and United States companies and syndicates are interested in oil and gas in Manitoba. Space does not permit mention of more than the largest and most active acreage holders.

Subsoil or mineral rights underlying the land of Manitoba, as is the case in all the western provinces, are owned either by the Provincial Government, in which case they are known as Crown rights or acreage, or by individuals or companies, when they are known as freehold rights or acreage. Exact figures are not available, but it is believed that Crown and freehold acreages in southwestern Manitoba are about equally divided. To the north, Crown acreage predominates. Freehold acreage is usually scattered at random in small blocks throughout the Crown properties.

California Standard, directly and through land holding companies, probably has in the vicinity of 3,000,000 acres of Crown and freehold rights. California Standard has operated in Manitoba since 1947, and in January 1953 had 21 wells producing.

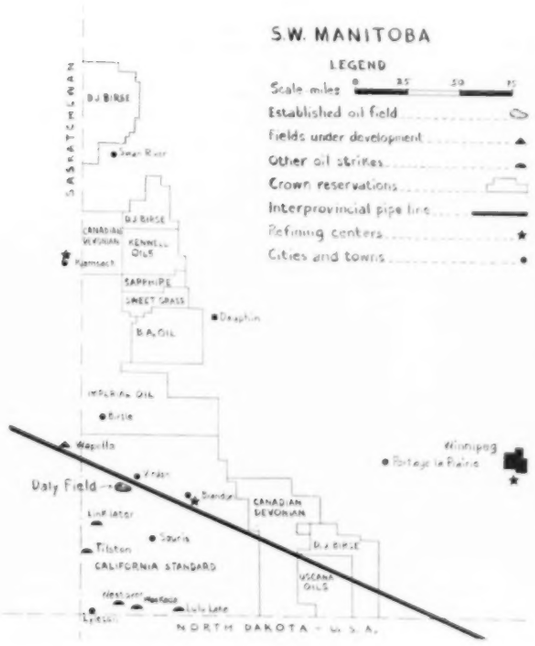
Imperial Oil Ltd. is rated the second largest land holder with some 2,500,000 acres of Crown and freehold rights. This company at the end of 1952 had three wells on production, although it has been at work in the province since 1947. The second largest producer is Canadian Superior Oil of California, which has eight wells. Details of this company's properties are not available.

Other large United States acreage holders include Canadian Gulf Oil, Shell Oil, Sun Oil and Union Oil of California. Some of the more prominent Canadian companies in Manitoba are British American Oil, Souris Valley Oil, Gridoil Freehold Leases, Western Leaseholds, Bailey Selburn, Canadian Devonian Petroleums, Canadian Pacific Railway and Triad and Associates. The reader is referred to the accompanying map for details of the larger Crown acreage holdings.

All production taken to date has been from the Mississippian limestone formations which in the Daly field occur at depths of 2,300 to 2,500 feet. Logs and other data of other producers to the south have not yet been released, although correlation work indicates that the horizon is 700 feet to 1,000 feet lower.

In the Daly the average thickness of pay zone is about 100 feet with the oil accumulation being considered as partially structural and partially stratigraphic. Average porosity is about nine percent, but the permeability is very low. There are streaks of up to a few hundred millidarcies.

Completion methods vary considerably, but all are directed toward overcoming the low permeability. Acidizing has not proved particularly successful because the whole zone is so tight that action is restricted very largely to the well bore. At times acid treatment has resulted in decreasing production to a very low point.



This field-expedient stove pipe arrangement, with small flame-thrower at bottom to supply heat, gives seismic crews chance to warm up during the day's shooting. Socony-Vacuum photo.

Shooting results have varied considerably, but on the average have not been particularly successful. The difficulty appears to lie in obtaining a reasonable degree of penetration of fracturing around the well bore and not wasting the explosive energy in pulverizing the rock around the hole.

The most successful method used—fluid fracturing—may be subdivided into (a) acidfrac, (b) Hydrafrac and (c) viscous oil technique. In the opinion of the main operator in the Daly field, the success of Hydrafrac treatment with sand has done more to stimulate development than any individual factor. Most wells that have been drilled in the immediate area show oil, but the problem has been one of recovery.

The marketing problem of the Daly field, which was a definite handicap due to lack of refinery capacity within economic range and willing to accept the crude, has now been overcome. California Standard, the principal operator in the field, negotiated contracts late in 1952 for feeding Daly field production into the Interprovincial pipe line.

It is probable that Manitoba can be credited with being the first province in Western Canada in which drilling for petroleum was undertaken. In 1887, the Manitoba Oil Co., long since defunct, sank two unsuccessful wells at a point some 12 miles south of Dauphin in the west central part of the province. In the following 62 years not more than 42 wells were put down in search of gas and oil. Most of these were relatively shallow and few of them were properly tested. The count for the last four years is: 1949, four wells; 1950, seven wells; 1951, 17 wells; and 1952, 72 wells. Knowledge of the subsurface stratigraphy of the sedimentary rocks of the province still remains relatively restricted.

In succeeding paragraphs brief commentary is given upon the stratigraphy and lithology of the southwestern section of Manitoba. As indicated previously, subsurface data available are still very limited and correlations with conditions elsewhere in the Williston Basin are of necessity more deductive than mathematical or the result of diagnostic fossil studies. Differences of opinion are many, as indicated in Table I, "Stratigraphic Section." The reader is referred to this chart for suggested thickness of formations as indicated from logs of wells drilled in the southwest triangle of the province. A limited number of these have now been released from confidential files.

The sedimentary rocks of Manitoba occupy a large triangle in the southwest portion of the province. The eastern boundary of this triangle is the junction with the Precambrian Shield which runs in northwesterly direction from southeast Manitoba. While the area of this triangle is close to 20 million acres, the sediments in the more easterly and northerly sections are comparatively thin, and it is not likely that more than a fifth of the area contains sediments of over 2,500 feet thickness, all of which are located in the southwest corner of the province.

The following may be regarded as a typical log of a Manitoba well. It is the discovery well in the Daly field:

Cal-Standard Daly No. 15-18
LSD 15-18-10-27, WPM

Location	**Feet**
Elevation-Ground	1,608.2
Total Depth	5,368
Completed Drilling	Feb. 1, 1951
Formation Tops	
Cretaceous	
1st Specks	950
2nd Specks	1,160
Ashville	1,280
Swan River	1,540
Jurassic	
Sandstone & Shale	1,595
Lime	2,120
Anhydrite	2,130
Triassic-Amaranth	Not Present
Mississippian	
Charles	2,190
Madison equivalent	2,224
Exshaw	2,505
Devonian	
Lyleton Shale	2,510
Jefferson equivalent	2,595
Red Beds	3,730
Salt	3,770
Winnipegosan Dolomite	4,132
Ashern	4,175
Silurian-Interlake	4,240
Sand Grains	4,505 & 4,555
Ordovician	
Stony Mountain—Upper	4,580
Stony Mountain Shale Member	4,680
Red River	4,745
Winnipeg	5,210
Precambrian	5,359

Structurally, the Manitoba sediments constitute the northeast flank of the Williston Basin. From the Precambrian Shield a series of Paleozoic and Mesozoic strata dip gently west and southwest into the deeper portions of the Basin. The dip of the Mesozoic strata which has surface showings over the greater part of the area is in the order of seven to ten feet per mile. The underlying Paleozoic beds, where there has been much erosion, have a dip of some 30 feet to the mile with successively younger Paleozoic beds occurring under the unconformity in a southwesterly direction. The Mississippian of the southwest corner of the province (the only formation providing commercial production to date) and most of the Devonian are truncated before they reach the surface.

Cambrian—To date no sediments of the Cambrian age have been identified in Manitoba, although they are reported to the west in Saskatchewan and Alberta and in North Dakota and Montana.

Ordovician — Sediments of the Ordovician are believed to underlie all of the southern parts of Manitoba west of the Precambrian Shield. The maximum thickness reported is approximately 800 feet, although the cumulative totals of the three formations constituting the Ordovician period in Manitoba indicate a possible maximum thickness of close to 1,000 feet.

Silurian—Deposits of the Silurian sediments attain their maximum thickness in the central part of the area under consideration and thin off to the south and west. At the Langord No. 1 well (LSD 5, Sec. 29-14-14, WPM), 605 feet of the formation is reported while in the Daly Field (Twp. 10, Rge. 27, WPM), the thickness is only about 325 feet. One principal unit is recognized, the Interlake or Stonewall. Porosity in general is reported as poor and there is evidence of eroded reef horizons in the upper sections.

Devonian — The Devonian strata in Manitoba, in common with the deposits elsewhere in the Williston Basin and the Alberta Syncline where erosion has not occurred, are by far the thickest of the Paleozoic era, amounting to over 1,700 feet in the Daly field. Only the bottom 400 feet is exposed in outcrop along the shores of Lakes Manitoba and Winnipegosis, and certain parts of the Devonian section appear to be missing in some wells.

Logs of wells drilled in southwestern Manitoba indicate four main lithologic units consisting of the Elm Point, Manitoban, Jefferson and Lyleton. A large number of sub-units are to be found in each of the four main units including dolomites, limestone, shale, anhydrite, red shales and shaly carbonate. The reader is referred to Table I in which is given a breakdown of the Devonian period as suggested by J. R. Ower of the California Standard Co. in a paper presented to the Canadian Institute of Mining and Metallurgy October 15, 1952. The components of the Jefferson Unit may be the approximate equivalent of the D1, D2, D3 or Nisku, Ireton and Cooking Lake formations of Alberta. Good porosity occurs at various horizons of the Devonian in Manitoba but to date, no accumulations of oil or gas have been discovered.

Mississippian—While rocks of the Mississippian age have considerable thickness and distribution in North Dakota and southern Saskatchewan, their occurrence in Manitoba is limited to a smaller triangle in the southwest corner of the province. A well drilled near Lyleton in the extreme southwest corner of the province intersected some 900 feet of beds resting on the Devonian strata and believed to belong to the Madison formation. In the Daly field, only 50 miles to the north, the Mississippian has thinned to less than 350 feet. To the east of Lyleton, a similar thinning of the section also occurs. Truncation of the Mississippian as calculated by subsurface correlations appears to occur along a line running roughly northwest from a point a little east of Brandon on the international boundary to intersect the Manitoba-Saskatchewan border some 125 miles north of the boundary. Accurate correlation, however, is difficult due to lack of data.

As the Mississippian is so far the only formation which has been productive of oil in Manitoba, a brief commentary on its structure would appear to be in order. Some uncertainty still exists as to correlation of sections with their counterparts in North Dakota and Saskatchewan. Three

units are believed to have been identified. The lowest is the Kinderhook and Banff sand, consisting of dark shale underlain by a few feet of fine silt, sand and limy silt. The Kinderhook is absent in the Daly field, but appears in wells to the south. Light oil is often present, but the unit is tight and non-commercial.

The central unit which is present in most wells reporting Mississippian is usually referred to as the Madison as it is believed to be the equivalent of the Lodgepole member of that formation in North Dakota and Saskatchewan. Several wells report a third unit resting on top of the Madison which it is suggested might be the equivalent of the Charles member of the Big Snowy of the Dakotas.

Commercial oil accumulations have all been found in the Madison. In the Daly field this formation consists chiefly of a thin bottom unit of shale overlain by a middle crinoidal zone up to 100 feet thick containing alternating layers of crinoidal, siliceous and shaly limestones with beds of red shale. The lithology varies considerably from well to well, and it is suggested that the porosity is proportional to the crinoidal limestone present. The top member of the formation is a dolomite anhydrite zone of up to 100 feet thickness. The member is usually stained and at times partially saturated with oil, but lacking in porosity.

Triassic — Deposition of sediments of the Triassic period occurred over a fairly large part of southwestern Manitoba. Sections up to 200 feet thick have been encountered as far north as Dauphin and as far east as Morden, although the "Red Beds" are not reported in several wells drilled in the Daly area. This Amaranth is lithologically similar to the Spearfish to the southwest. No diagnostic fossils have been found in the Amaranth and accordingly a definite correlation cannot be made. Some authorities consider the Amaranth as a lower section of the Jurassic.

Jurassic—While correlation calculations indicate that the Jurassic covered a considerable portion of southwest Manitoba, so far no outcrops have been reported. The main unit consists of the Sundance, made up of calcareous marine shales overlying a limestone and dolomite section. Resting upon the marine shales is a section of non-marine variegated shales which are topped by a further section of marine shales which contain abundant shell fragments. The upper Jurassic member consists of gray and green shale and shaly sandstone suggestive of the Morrison formation of North Dakota. While the Jurassic has been productive in eastern Saskatchewan at Wapella, it has not to date been found oil bearing in Manitoba.

Cretaceous—The Cretaceous period rocks of Manitoba which are well exposed in various districts consist of five main formations or groups as indicated in Table I. Little of interest has been found to date in the Cretaceous, although the calcareous shales of the Boyne tend to be petroliferous and much of the shales contain white specks, thus providing a contour marker. The youngest Cretaceous formation consists of the Riding Mountain, which in the southwest is 1,000 feet and over in thickness. It is made up of gray shales, mostly hard, interbedded at times near the base of the section with soft bentonitic shale.

TABLE I

SOUTHWESTERN MANITOBA

Stratigraphic Section

Age	Formation & Member	Thickness Feet	Lithology
Cretaceous	Riding Mountain	1,000	Hard Gray Shales
	Vermilion River { Pembina	50	Carbonaceous Shales
	Boyne	125	Calcareous Shales—white specks
	Morden	150	Dark Gray Shales
	Favel	120	Calcareous Speckled Shales
	Ashville	200	Shale, with limestone sand & silt
	Swan River	80-100	Shales, sandstones—coal seams
Jurassic	Morrison ?	150	Gray Shale & Shaly Sandstone
	Sundance	400	Dolomite with Calcareous Shales
Triassic	Amaranth ?	180	Shales, Sandstones & evaporates
Mississippian	Charles ?	30	Shales, Limestone
	Madison—Lodgepole Equivalent?	300	Shaly & Crinoidal Limestone, Dolomite
	Kinderhook & Banff Sand	20	Shales, sand, silt
Devonian	Lyleton / Three Forks	100	Red Beds
	Jefferson or Moose Jaw { D1 ?	100	Dolomite, some Anhydrite
	D2 ?	300	Limestone, Dolomite
	D3 ?	170	Porous Dolomite
	Jefferson or Manitoban { Duperow	300	Limestone, Shale & Anhydrite
	Hudson Bay	220	Limestone, partly organic
	Elm Point { Biggar	400	Salt, Anhydrite, Red Shale
	Winnipegosan	70	Dolomite—partly organic
	Ashern	30	Red Beds
Silurian	Interlake or Stonewall	400	Dolomite on Calcareous Shale
Ordovician	Stony Mountain	150	Red Shale, Limestone & Dolomite
	Red River	200	Limestone & Dolomites
	Winnipeg	150	Sand overlain with Green Shale
Precambrian			Igneous & Metamorphic

The last of the cable tool rigs in Manitoba, used in drilling the Brandon-Coutts Nos. 1 and 2 wells.

While Manitoba lacks the depth of sediments found to the southwest in the Williston Basin, and at the same time has a relatively small petroliferous area, she cannot be written off as the "poor relation" of her neighboring states and provinces. The ratio of finds to wildcat wells drilled has been high, and it may well be that supporters of the "up structure migration" theory have found a strong argument in their favor. The absence of the discovery of gas either as a cap or in solution in Manitoba and the lack of water drive combined with exceptionally low permeability are major problems. These are largely of a mechanical nature and as such, the solution can be left with confidence to the superintendents of production. Fluid fracturing in its various forms and possibly ultrasonic scrambling may be among the answers.

It is particularly interesting to note that many of the companies mentioned in previous paragraphs were formed or entered Canada initially to carry on oil and gas exploration operations in Alberta, but during the past two years have acquired properties and become active in Manitoba. There has been the usual seasonal slowdown in drilling operations during the winter and even at the present time there are only two rigs in action. On the other hand, plans have been made for extending activities and it is anticipated that once the roads and ground are in good shape, drilling and geophysical operations will be resumed on a large scale.

Canada's greatest oil year in 1952

By J. L. Irwin

JUST AFTER THE TURN of the year, a letter arrived in Edmonton, Alberta from an oil executive in London, England. Among other things, it said: "Your industry is now so vast in its ramifications, and its tentacles spreading . . ."

This unfinished sentence contains many implications. It is a definite acknowledgement from the older oil worlds of Europe and the Middle and Far East that Canada has sprung in half a decade from obscurity to fame and power amongst the oil producing countries of the world. Coming from the heart of the British Empire to the British Dominion of Canada, this acknowledgement is indeed welcome. Such an admission might suggest perhaps, in a future not too remote, a closer bond between Britain and Canada under the heading of world economics.

In 1946, just before the discovery of the great Leduc field, Canada's crude oil reserves were estimated at around 45 million barrels. At the close of 1952 the estimate was raised to 1.68 billion barrels.

Speaking in round figures, the following information covering the last six years in oil and gas development in Western Canada is of interest: lands under lease or reservation have moved from 20 million to 195 million acres; exploration expenditures have risen from 12 to 300 million dollars annually; drilling rigs from 20 to about 170; annual oil and gas well completions from less than 100 to over 1,060; geophysical parties at work from less than a dozen to 127; natural gas reserves from about 2 trillion to 10.5 trillion cubic feet; maximum efficient rate of daily oil production has risen from 19,000 to 275,000 barrels, and actual production from 19,000 to 186,000 barrels. These statistical facts briefly emphasize the great progress which has been made over the past six years.

W. D. C. Mackenzie, manager of the western producing division of Imperial Oil Ltd., at a meeting of the American Institute of Mining and Metallurgical Engineers at Duluth, Minnesota on January 12, 1953, estimated an oil reserve for Western Canada of 25 billion barrels will be proved in 40 years time as a result of an expanded oil exploration program.

Mr. Mackenzie used three different approaches to secure an average. First was an analysis of the history of discovery of the midcontinent United States which compares from a geological viewpoint with the prospective oil territory of Western Canada. Following this he took into consideration the world average oil accumulation factor per cubic mile of sedimentary rock and finished by projecting the current discovery rate in Western Canada over a 40-year period.

A portion of his address is of sufficient immediate interest to reproduce. "Let us take 46 billion barrels," he stated, "as being the result of some 30 to 40 years of exploration effort in the great basin of the United States, and make a simple comparison with Western Canada. We have to make some adjustment for size, and an allowance for the fact that exploration will go somewhat slower in the Northwest Territories of Canada. . . . To me that adjustment factor looks like about 60 percent, so that by a simple comparison I arrive at a figure of 28 billion barrels of reserves for Western Canada.

"It has been said that in the sedimentary basins of the world, the average accumulation factor is 30,000 barrels per cubic mile of sediments. The volume of Western Canada's basin is roughly 1,000,000 cubic miles, so that by this approach we arrive at a reserve of 30 billion barrels.

"The third method of guessing is by applying the current rate of finding to a 40-year period. Naturally there are cautions to be observed in doing this, but I believe many of the errors are self-compensating. I roughly estimate that the industry is now discovering at the rate of 400 million barrels per year, so that in 40 years we should have found 16 billion barrels. Now, by three different approaches, we have obtained figures of 16 billion, 28 billion and 30 billion. The average is 25 billion."

Mr. Mackenzie then touched on the

A Cities Service plane prepares to visit the company's Lubicon River test in northern Alberta. Photo by Fritz Henle.

many problems covering exploration for oil in Western Canada. "I have no doubt," he said, "that the oil will be more difficult to find in the future, but offsetting this I feel confident that the effort will be greater, and the tremendous wealth of subsurface knowledge which will be obtained will give us technical aids which we cannot today envisage."

Since 1947, when the great Leduc field made its appearance and changed the entire picture of Canada's oil industry, each succeeding year has rung up a new record of achievement. The huge annual increases in oil production have of necessity brought equally great increases in the growth and activities of all other branches of the oil industry: construction of new refineries and extension of those already established; construction of pipe lines and lake tankers of enlarged capacity; rapid growth of geological and geophysical units spread throughout Western Canada; necessary increase of all varieties of supply companies to cater to the needs of active development; continual opening of new offices for the accommodation of geologists, geophysicists, engineers, and other types of technicians; new offices for the makers of maps for which the demand continually increases, and for trust companies, brokerage houses and for headquarters and branch offices of oil companies. Lastly, there is obviously a great increase in the numbers of different forms of businesses which are responsible for supplying the wants of men in the fields as well as in the towns: hotels, restaurants, garages and shops of many kinds.

While Alberta supplied the bulk of oil and gas production, there were noticeable increases in this respect in Saskatchewan, Manitoba and British Columbia. Added to the importance of considerably increased oil production were, as already stated, other factors that made 1952 the greatest year to date.

New refineries and major absorption plants were opened, others were projected, the Trans Mountain oil pipe line to the Pacific Coast was started, and the Interprovincial Pipe Line planned for the extension of that great line from Superior, Wisconsin to Sarnia, Ontario, to start in the spring of 1953. It was Canada's greatest oil and gas year to date.

Since the discovery well made its appearance in Leduc six years ago, the increases in annual oil production totals have been more spectacular in each succeeding year. Increases in the activities of all the varying interests related to the oil industry in Western Canada have paralleled this tremendous growth.

Oil production in Alberta during 1952 rose to still another great record. By the close of the year, Alberta's production total stood at 58,915,723 barrels to compare with 45,915,384 in 1951, an increase of 13,000,339 barrels.

The valuation of 1952's production was $139,657,915 to compare with $115,809,221 the year before, an increase of $23,848,694.

It is of particular interest to note that prior to the discovery of Leduc in February, 1947, Alberta from 1914 to 1946 (a period of 32 years) had produced a cumulative total of 90,325,390 barrels of oil valued at $151,688,485.

Since the discovery of Leduc to the close of 1952 (six years) the province has produced 170,437,505 barrels valued at $448,172,201, bringing the cumulative totals for Alberta from 1914 to 1952, inclusive (a period of 38 years) to 260,762,895 barrels of oil valued at $599,860,686.

Because of that discovery six years ago, a discovery which immediately halted a yearly oil decline, we have to show on our records today a cumulative oil production in excess of a quarter of a billion barrels which has brought revenues well in excess of a half billion dollars.

Alberta oil production by principal fields is shown in Table I and Dominion production by provinces in Table II. Alberta continued to lead with 96.24 percent of Dominion output. Value of Alberta production in 1952 was $143,116,804 compared with $118,316,242 in 1951, an increase of $24,800,362.

Natural gas production for 1952 came to a total of 95,697,432 mcf to compare

TABLE I

ALBERTA CRUDE PRODUCTION
(Barrels)

Field	1952	1951	Increase
Acheson	2,016,855	918,158	1,098,677
Armena-Camrose	1,307,526	63,078	1,244,448
Armisie	103,594	25,293	78,301
Big Valley	657,875	155,580	502,295
Bonnie Glen	743,490	———	New Field
Conrad	135,037	142,497	*7,460
Drumheller	175,688	15,058	160,630
Duhamel	347,140	184,582	162,553
Excelsior	933,644	723,005	210,639
Fenn	343,766	———	New Field
Glen Park	282,719	22,443	260,275
Golden Spike	1,279,103	640,972	638,131
Joseph Lake	998,268	727,936	270,332
Leduc-Woodbend	17,845,212	13,743,118	4,102,094
Lloydminster	1,057,354	900,469	156,885
Malmo	270,474	———	New Field
New Norway	287,988	20,664	267,324
North Big Valley	74,446	———	New Field
Pigeon Lake, Gulf C.P.R. Fiveland, No. 4 well	98,115	———	New Field
Redwater	23,975,842	23,177,607	798,235
Stettler	607,078	606,068	1,010
Taber	81,464	182,449	*100,985
Turner Valley	2,655,007	2,952,307	*297,300
Wizard Lake	1,696,077	190,595	1,505,482

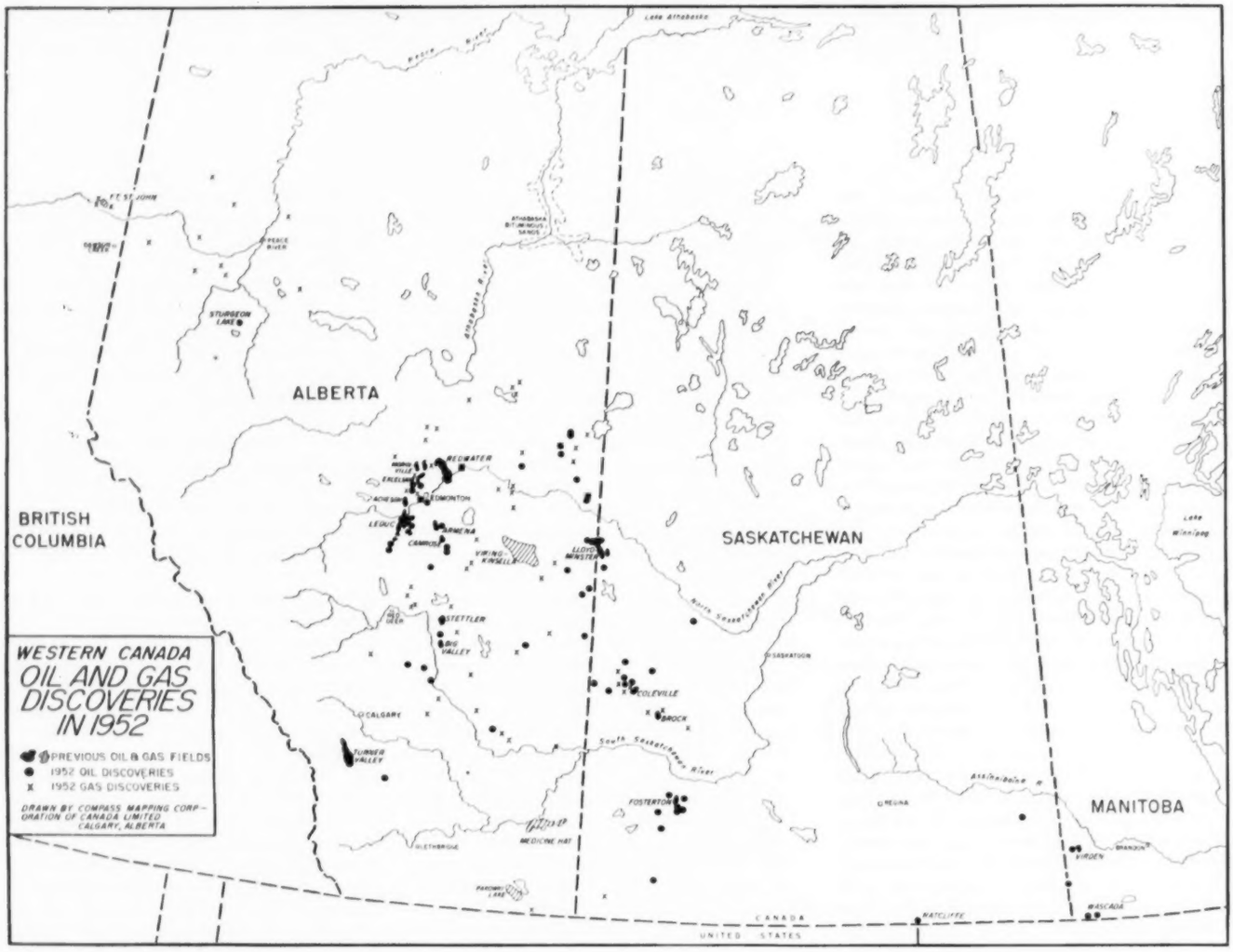
*Decrease

TABLE II

CANADIAN CRUDE PRODUCTION
(Barrels)

Province	1952	1951
Alberta	58,915,723	45,915,384
Saskatchewan	1,677,900	1,248,281
Manitoba	110,550	10,698
Ontario	192,000	197,171
Northwest Territories	301,000	227,449
New Brunswick	14,500	15,551
Total	61,211,673	47,614,534

Century et al well which extended the Acheson field. Well tested 88 barrels per hour of 38 gravity clean oil. Photo by Wells, Edmonton.



with 85,382,154 mcf in 1951. Turner Valley, as in 1951, was the largest producing field in Alberta with 32,069,085 mcf in 1952 in comparison with 35,720,661 mcf in 1951.

Completed wells in 1952 totalled 1,060, made up of 922 crude oil wells, 121 dry gas wells and 17 wet gas wells. There were 134 indicated discoveries for the year, 61 of which were crude oil, 61 dry gas and 12 wet gas.

Drilling rigs operating by the end of 1952 totalled 170, of which 67 were classified as wildcats and 103 were drilled in established fields.

By December 31, 1952, 127 geophysical parties were in operation, 120 being seismograph and seven gravity meter.

Outstanding among discoveries in 1952 were those made in the Bonnie Glen-Pigeon Lake Devonian reef area in central Alberta. Fort St. John in northeast British Columbia opened in a few months a major wet gas reserve of more than 1,300 billion cubic feet, taking second place in this respect only to Pincher Creek in southwest Alberta.

Production increases in newer fields were especially noticeable in Acheson, Armena-Camrose, Big Valley, Bonnie Glen, Drumheller, Duhamel, Fenn, Glen Park, Golden Spike, Malmo, New Norway, Pigeon Lake, and Wizard Lake.

The turn of the year provided sensational discoveries as well. The Stanolind-Imperial well 5½ miles northwest of Edmonton flowed light crude oil at the rate of 74 barrels an hour and proved production in five zones from the Viking sand to the Devonian reef.

Due south by 3½ miles of this producer, the Century-Melton-Monarch well flowed at the rate of 88 barrels of clean 38 gravity oil, credited with being one of the heaviest flows produced in Alberta from the basal quartz formations of the Lower Cretaceous. This success proved a northerly extension of the Acheson field.

At Erskine, just west of Stettler, the Merrill-Mitmore well flowed oil at the rate of about 60 barrels per hour from the interval 5,363 to 5,378 feet. Just before this a major wet gas producer was brought in at Buck Lake by Canadian-Delhi Company and Associates, while three months later at Homeglen, 50 miles southwest of Edmonton, California Standard produced another major wet gasser.

In July of 1952, G. L. Stewart, president of Imperial Oil Company, stated in a Calgary interview that the best hopes for that city of getting a reduction in gasoline prices lay in the production of another major oil field in southern Alberta to replace declining Turner Valley.

In March 1953 important oil discoveries were made in the general area south and east of Calgary, one by Royalite-Anglo at Eyremore in the Devonian, one by Texaco Exploration at Enchant in the Madison and one by a private group at Grassy Lake in the Ellis section. In the vicinity of these three discoveries is the 40,000-acre oil and gas reservation of Century Oils, where last summer a slim core drill tapped natural gas at 800 feet. Deep test drilling of this general area might procure for southern Alberta the second major oil field for which there now is need.

Pipe line construction on a major scale

featured in the news in Western Canada last year. The two largest projects were the building of the Trans Mountain oil pipe line from Edmonton to Vancouver, British Columbia, a distance of 711 miles; and the extension of the Interprovincial oil pipe line from Superior, Wisconsin to Sarnia, Ontario, a distance of 635 miles.

A third major pipe line, for export of natural gas from the Peace River district of northwest Alberta and northeast British Columbia, may be authorized by the U.S. Federal Power Commission in Washington in 1953. Destination of the line would be Vancouver and over the United States border to Washington and Oregon. The applicant company for the proposed line is Westcoast Transmission Co., whose project has already been authorized by the Alberta Government and the Board of Transport Commissioners of the Government of Canada. In May, 1953, the Alberta Petroleum and Natural Gas Conservation Board will re-open hearings of gas export applicant companies which may result in the authorization of a second line to Eastern Canada. Should gas export be permitted both east and west to be added to the construction of the two oil pipe lines in the same direction, it will mean that Canada's oil and gas industry in the present year of 1953 will have raised the greatest milestone in its history.

The prospect of Alberta's natural gas being exported to the east and west of Canada and to the United States now looks very real. An official announcement on this vitally important economic question is expected during the current year. Should approval be given, an upward surge of progress of gigantic dimensions will immediately become noticeable in Canada's already vast oil and natural gas industry.

Sales of asphalt made by Husky and Excelsior refineries at Lloydminster, Alberta, in the great black oil area, were about doubled in 1952. Asphalt produced from this extensive area and from the tar sand area of McMurray, from the viewpoint of ductility-penetration and ductility-softening point ratios, is officially claimed as the finest in the world. Alberta asphalt is included more and more in the annual road-building programs of Western Canada.

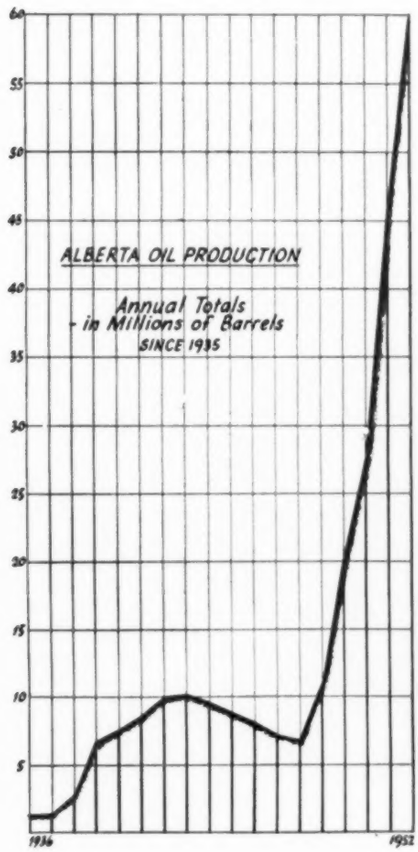
There are now plans for four absorption plants before the Petroleum and Natural Gas Conservation Board to be erected by different companies for the purpose of processing gas. One is to be constructed in the south of the Leduc field, one at Wizard Lake, one at Joseph Lake and the fourth in the general refinery area just southeast of Edmonton's city limits.

From year to year during the last five years one has heard the statement that the surface of Canada's oil development has not yet been scratched. The excuse for this repetition is that it still is true. Each year eclipses its predecessor.

Alberta continues to be the dominant factor in Canada's oil picture, but other provinces are now beginning to expand. Saskatchewan, Manitoba, and British Columbia all presented impressive increases in oil and gas development last year, not only in actual production, but also in the large exploratory programs that were maintained. The Northwest Territories will without question come powerfully into the oil picture in the very near future. Development and exploratory work is being carried out in Ontario, the Gaspe Peninsula and the Maritimes. The "industry is now so vast in its ramifications, and its tentacles are spreading . . . " From coast to coast and beyond the seas, it is now universally known as "Canada's Oil."

Last year Canada took fourth place in importance in the Western Hemisphere. We are now told she may soon surpass Mexico and come third. Last year she almost tied with Indonesia. Should she pass both these countries in 1953, she will come seventh in importance amongst the 53 oil producing countries of the world.

The year 1952 was Canada's greatest oil year and 1953 promises further greatness.



Preparing for a drill-stem test at Cities Service Lubicon River well. Photo by Fritz Henle for Cities Service.

A view of the city and river of Peace River in northern Alberta. Photo by N. J. Parrino. All photographs with this article are reproduced through the courtesy of the photograph library of the Cities Service Company.

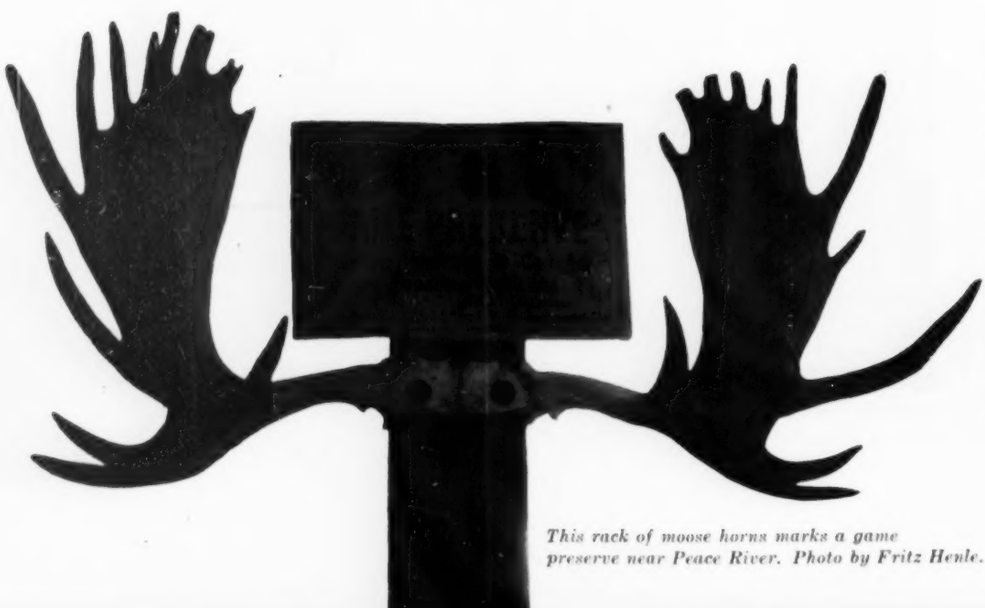
Huge gas reserves reward drilling in Fort St. John— Peace River area

ASTRIDE THE British Columbia-Alberta provincial border lies a sedimentary area of about 75 million acres in which significant gas discoveries have been made. Some oil also has been discovered, but thus far gas has been the principal find.

Known as the Fort St. John-Peace River district, the area may soon be the source of gas for the last great market in the United States not now served by a major gas line. Alberta and British Columbia governments have determined that adequate reserves have been discovered to warrant the construction of a line and permission has been granted to export the gas. The Canadian Federal Government has announced that it will honor the provincial export licenses.

Whether the gas will find an outlet in the United States now depends on the Federal Power Commission which currently is conducting hearings at Washington, D. C. to determine whether gas from the United States or Canada is to be sold in the Pacific Northwest. A competing group seeks to build a line from Arizona and New Mexico to Oregon and Washington but does not agree to serve southern British Columbia markets. These would not be given gas if the United States line is approved since the Peace River line then would become uneconomic. California, as well as British Columbia, also objects to the building of the United States line. Final decision probably will not be made by the Federal Power Commission before October 1953 so that in any case the Pacific Northwest will not be supplied until the fall of 1954.

First drilling in the Peace River-Fort St. John district was done in 1916 although visible oil and gas seepages had



This rack of moose horns marks a game preserve near Peace River. Photo by Fritz Henle.

A combination automobile and railroad bridge across the Peace River. In the foreground is seen the flame from an abandoned gas well which has been burning for 17 years. Photo by Fritz Henle.

been noted in Northern British Columbia as early as 1905. In 1921-23 a subsidiary of Imperial Oil Ltd. discovered the Pouce Coupe field with several producing horizons. Again in 1948, Imperial began exploratory drilling in the area, resulting in the Normandville discovery of gas in several horizons and oil in Upper Devonian dolomite.

Since the Normandville discovery, a number of individuals and oil companies have taken exploration permits covering large areas in both British Columbia and Alberta. Development of the British Columbia part of the region received great impetus again in November 1951 when Pacific Petroleums Ltd. discovered the Fort St. John field. Other finds on the British Columbia side of the line include the Sunrise and Alaska Highway fields. The Pouce Coupe field is astride the provincial boundary. Eight fields are indicated in Alberta in addition to Pouce Coupe.

To test the importance of its Fort St. John find, Pacific Petroleums and its associated companies have been engaged in an active step-out drilling campaign. In October of 1952 George L. McMahon, president of Pacific Petroleums, told the British Columbia section of the Canadian Institute of Mining and Metallurgy that the group of companies had spent $5.25 million on drilling and at that time was spending at the rate of $10 million per year. The companies doing most of the work include Phillips Petroleum Co., Sunray Oil Corp., Union Oil Co. of Calif. and Hudson's Bay Oil and Gas Company.

The Fort St. John field is now proved to extend for a distance of about 22 miles in a northwest-southeast direction along the Alaska Highway. Limits to the field have not been found in either direction. Step-outs as far away as five miles from previous wells have proved productive.

Several additional structures have been mapped by Pacific seismic crews, and gas has been found in two horizons in a test well on one of these, 13 miles south of Ft. St. John. A group of other companies has found gas in a wildcat 30 miles north of Fort St. John. The well was drilled by Texaco Exploration Co., Gulf Oil Corp., Socony Vacuum Oil Co., and Shell Oil Co.

Importance is lent to the Fort St. John-Peace River fields by the fact that gas is

Constable Victor Malacrida is giving Janet Fox a parking ticket at Peace River in northern Alberta. The limit plainly is 48 hours. Photo by Fritz Henle.

Above, Warren Gunn, chief of Cities Service Co. oil exploration party, inspects the results of an artesian water flow from a shot hole drilled in the course of seismic prospecting near Clive, Alberta. Photo by Anthony Linck. Below, Sol Meltzer, Cities Service geologist "sitting on" a drilling operation at Crooked Creek in northern Alberta. Photo by N. J. Parrino.

found in as many as eight different horizons. Four of the zones have had oil showings. Gas reserves in the district are being increased from week to week so that it is difficult to make an assessment. Dr. George S. Hume, director general of scientific surveys for the Dominion of Canada, and Alexis Ignatieff placed reserves at 2.5 trillion cubic feet as a result of a survey made about a year ago. It was on the basis of these findings that the Board of Transport Commissions of Canada authorized construction of a 24-inch gas line to the United States border and the Department of Trade and Commerce issued a gas export license.

Dr. Theo. A. Link has suggested that a gas reserve of at least five trillion cubic feet can easily be established in the Fort St. John-Peace River district in three or four years if the proposed gas line is constructed so that a market is developed to make drilling worth while. Such a reserve would eclipse even the great Pincher Creek area and provide at least a 50-year reserve of gas for the Pacific Northwest.

The latest Hume-Ignatieff report, dated August 31, 1942, places known British Columbia gas reserves at 1.55 trillion cubic feet, of which 80 percent is in the Fort St. John field. On the Alberta side of the line, reserves were placed at 921 billion cubic feet. Development in Alberta was retarded earlier by the export policy of provincial authorities.

As mentioned above, as many as eight producing horizons have been penetrated in the Fort St. John field. The stratigraphic column of the area might permit production from as many as a dozen horizons extending from the Upper Cretaceous down to the Devonian. Thus far the Upper Cretaceous and Triassic sequences have been most prolific gas producers. In the Upper Cretaceous the Cadotte sandstone is the most important reservoir. It has a layer of about 100 feet of chert and quartz. Three levels in the Triassic are prolific producers, particularly in sandstone and dolomite. In the Permo-Pennsylvanian series underlying the Triassic, gas is obtained in the Fort St. John area from dolomites. The Mississippian, from which gas is produced in the great fields in southern Alberta, also is present in the Peace River district.

An astonishing feature of the British Columbia gas development has been the amassing of such great reserves in such a short period and by the drilling of so few wells. Only one well was completed in British Columbia in 1951 and 16 in 1952, of which 12 were classed as wildcats and four as development wells. Of the 12 wildcats completed, four were gas wells, giving the astonishing success ratio of 33 percent.

With 75 million acres to be explored in the favorable sedimentary region, the wildcatter has ample space in which to add greatly to both oil and gas reserves of the Fort St. John-Peace River district.

Natural gas in Western Canada

Floyd Kellogg Beach is a consulting engineer who has been intimately associated with Canadian oil and gas developments in Canada since 1927. He was in the Canadian army in World War I and served both Dominion and Alberta governments in an engineering capacity over a period of some 23 years before his retirement in 1950. In addition to his current engineering work, Mr. Beach is western field editor for Canadian Oil and Gas Industries.

By Floyd K. Beach

IN 1952 WESTERN CANADA had the most active year of oil and gas exploration and development that has been recorded. Alberta continued to lead the procession, but with discoveries in the North Dakota portion of the Williston Basin catching the public eye, exploration in Saskatchewan and Manitoba was stepped up. The search for sufficient gas to fill a pipe line to the west coast stimulated exploration in the Peace River block of British Columbia, and even the Northwest Territories saw a dozen wildcats drilled.

Very substantial reserves of gas are in sight and the reserves have increased at a remarkable pace. At the beginning of 1952 the Conservation Board placed the reserves at 6.8 trillion cubic feet and added that "in drilling 400-500 wildcat wells per year, the Province of Alberta can safely anticipate the development of further established reserves at an average rate of at least one trillion cubic feet per year for at least 8-10 years." The Board's estimate was highly conservative, for a submission by DeGolyer and MacNaughton in August, 1951 put "proved" reserves at 8.6 trillion plus 2.6 trillion "probable," but less clearly defined, and 11 trillion "possible"—that is, defined by more widely spaced wells and less definite evidence.

In 1912 a pipe line from Bow Island to Calgary, 16-inch O.D. and about 175 miles long, was at the time the most daring venture to be recorded in the industry. The only backing for the venture consisted in the fact that several wells along a stretch of about three miles had found open flows of 4 to 8.5 million cubic feet daily and had closed pressure of 800 psi. All of the wells were drilled with cable tools. No cores were heard of at that time and thickness of sand was not known. By 1919 deliverability had dropped so seriously that Calgary customers had to heat their houses with coal in winter and in 1920 the field was practically exhausted.

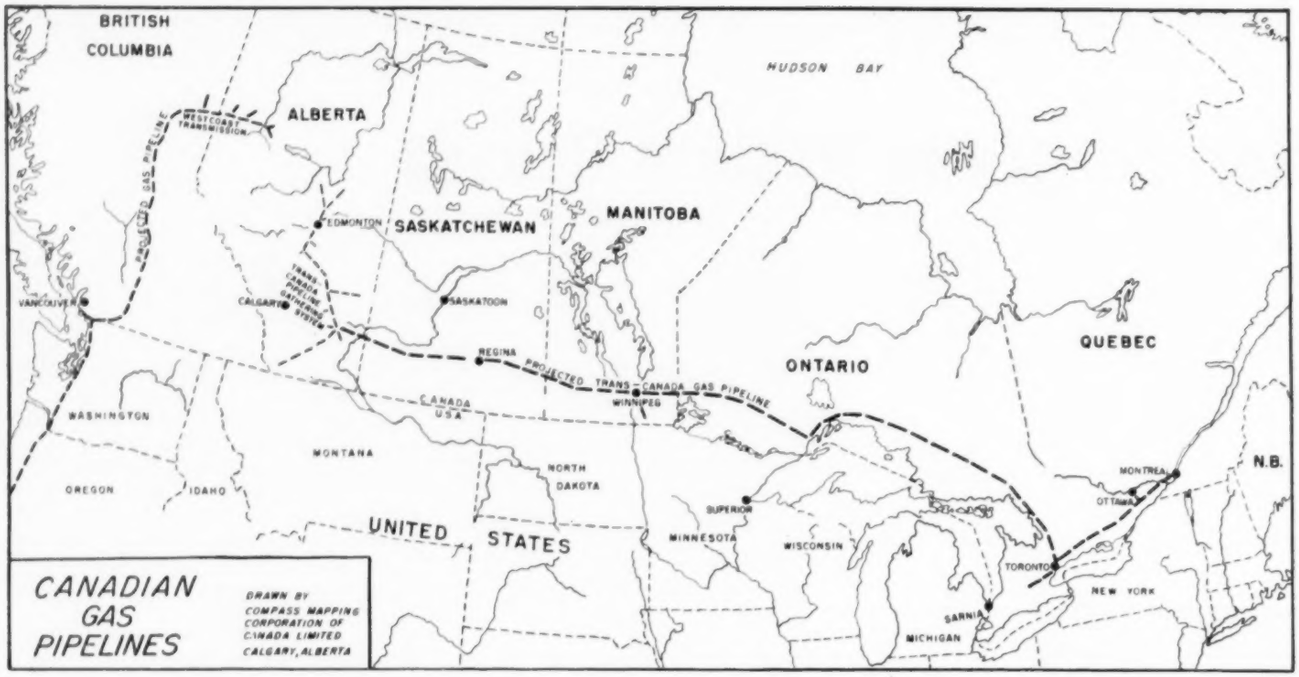
Today wells drilled by rotary tools core the most promising sands and reef occurrences and have a wealth of evidence as to porosity, permeability, gas analysis and pressure. While full delineation of the producing area can only be obtained by development drilling, seismic surveys usually give some indication that permits reasonable interpretation of the extent of pools discovered. Sometimes a well is drilled within an area that has been delineated as proven only to find no gas, and such happenings naturally embarrass the person who made a reserve estimate, but the many new discoveries that turn up every year greatly offset such adverse developments.

Very few operators have gone out deliberately to find gas, and if gas is found in the search for oil, they do not normally spend money to outline the extent of the discovery. There is a very sound financial reason for this, for if they put an investment of a dollar into such a project, and have to wait—say 20 years—for a return from the investment, the investment will have doubled by the time the revenue starts, supposing money to be worth five percent simple interest, or $2.65 at five percent compound interest. If the gas found is worth a dollar and we look to its present worth at five percent simple interest, in 20 years the gas is worth exactly nothing, although if discounted on a logarithmic basis, it actually is worth 35.4 cents. Again, if the well should be equipped ready to produce, an expenditure would be needed throughout the period to protect the surface equipment against tampering by the public and against the effects of corrosion, and rentals on the lease would make the venture a prohibitive one financially.

With these comments, it should be sufficient to say that knowledge of reserves cannot be 100 percent correct until revenue is in sight, but the knowledge is so much better than it was 30 years ago that capital is quite willing to venture into the field of piping gas to the consumer.

Political considerations have been the stumbling block against which the marketing of gas has been stopped. In Alberta the agricultural population has envied the city dweller his cheap fuel and convenient utility. The present Alberta government, however, has now come to realize the facts of life and promises export will be permitted when the Conservation Board is satisfied that reserves are adequate.

Permission to export limited gas from the Peace River district of Alberta was granted early in 1952. Pacific Petroleums



did very active exploration in the Fort St. John area of British Columbia and found gas in numerous horizons and spread over a sufficient area to indicate adequate supplies for the projected pipe line. The Dominion Government's Department of Transport has approved the construction of a pipe line following a careful study by Dr. G. S. Hume and A. Ignatieff of the federal Department of Mines and Technical Surveys. As we write, there is a hearing being held before the Federal Power Commission at Washington. Other interests propose to serve the Pacific Northwest States from San Juan basin and we cannot at the moment forecast the results of the hearing. It seems certain that Canadian consumption alone would not be sufficient to warrant a line to Vancouver and Trail in British Columbia and the market in Seattle, Portland and neighboring communities will be needed to make the project economic.

Trans Canada Pipelines, a subsidiary of Delhi, has been in the picture as a proposed supplier of gas to Ontario. Their consultants, DeGolyer and MacNaughton of Dallas, have most painstakingly covered old and new discoveries of gas and will submit a new and most complete coverage of Alberta gas reserves at a hearing before the Conservation Board to be held starting June 8.

Several other applicants for permission to export gas from Alberta will doubtless continue their submissions, although from all we can observe none of the other applicants are making studies of gas reserves that compare with the one being prepared for Delhi.

Variations in the proposal involve in one case a line to Winnipeg with a southward branch to serve Minneapolis. In another case, the route would parallel the Interprovincial pipe line for oil, reaching Ontario in that way. Other alternatives may be submitted of which we may know nothing until the submissions are put in. Some proposals made in the past involved delivery of gas to a western United States market and reciprocal delivery (from perhaps a Texas source) of gas for Ontario.

The most recent pronouncements from political sources include reiteration by the Hon. Ernest Manning, premier of Alberta, that export of gas will be authorized by his province as soon as the Conservation Board is assured there is an exportable surplus. He amplified this statement by remarking that only with export can Alberta hope to cash in on by-products such as sulfur and LPGas.

The province of Saskatchewan has found some gas, and although the discoveries to date scarcely indicate reserves greater than demands within the province, the government has enunciated a policy respecting export.

The Hon. C. D. Howe, Minister of Transport at Ottawa, has expressed his view that gas should be served to Canadian markets before export outside Canada is considered.

Considering decisions by the Federal Power Commission in refusing export of gas to Ontario on a firm delivery basis before demands within the United States are met, we believe Mr. Howe has taken a proper stand. Construction of pipelines involves fixed charges, to be amortized over a rather long period, and expenditures by consumers on equipment that should not be made worthless by early discontinuance of gas supply. So long as continuity of supply rests within the authority of one government there is less danger that shifts in policy in the political world will have an adverse effect on investment. The cost of an all-Canadian line to the east may run a bit higher than a line that crosses the northern states, and it is possible that such an alternative might be reached, but the delivery of gas on a firm basis should probably be limited to Canadian outlets so far as we can now observe, at least when considering eastward movement of gas from Alberta.

The same considerations do not apply to oil and we expect that oil will move rather freely to the most advantageous markets.

Celanese is building a plant at Edmonton involving use of hydrocarbons and pulp in the manufacture of rayon, etc. Canadian Industries Ltd. has an Edmonton plant on the way to completion for the manufacture of Polythene (polyethylene). Sherritt Gordon Mines has a plant under way at Fort Saskatchewan, some 20 miles east of Edmonton, for the reduction of nickel ore. Sulfur is being turned out at Jumping Pound and at Turner Valley, and several other sources of gas rich in hydrogen sulfide are known. Canada could become self sufficient in sulfur once gas export is authorized and there might even be an exportable surplus. A plant at Kimberley, B. C., to turn out sulfuric acid from metallic sulfides will be ready some time in the coming summer, although its objective involves combining the product with phosphates for fertilizer. At Calgary the manufacture of ammonium nitrate continues and Canadian Industries Ltd. has an explosives plant near the city.

Pending clarification of future policy on export of gas to the Pacific Northwest and to the east, there is some development of local gas lines for nearby domestic consumption in addition to the petrochemical usages listed above. A gas distributing system is under development in Saskatchewan and increases in Alberta demand are being supplied.

Shell Oil Company of Canada Ltd. continues to develop the Jumping Pound gas field in Alberta. The company now has seven producing wells and is developing additional wells in the field. Expansion of the Jumping Pound natural gas treating plant, started during 1952, will raise the capacity by 10 million cubic feet, bringing it to a total of about 40 million cubic feet per day. This added production will help to meet the increase in demand for natural gas in Calgary and other southern Alberta communities. It is understood that further expansion is planned for the Jumping Pound plant during the current year which will raise the capacity to approximately 50 million cubic feet per day.

Shell's Jumping Pound gas recovery plant began operation in May, 1951 with an initial capacity of 20 million cubic feet daily.

Adjacent to the gas plant, the sulfur extraction plant unit completed early in 1952 is in full operation producing elemental sulfur at the rate of about 22 tons per day. This product is sold to the pulp and paper industry in British Columbia.

Present developments at the Jumping Pound field represent a multi-million dollar investment. It was first recognized as an important gas reserve by Dr. G. S. Hume, Canadian Geological Survey, and explored by R. A. Brown, Calgary, in the 1930's. In 1940 Shell of Canada entered the field when it made an exploration agreement with the Brown interests, and carried out a two-year seismograph study of the area. Subsequent drilling indicated a major gas field, but it was shut down owing to lack of market for the gas.

In 1950 an agreement was entered into between Shell and the Canadian Western Natural Gas Co., whereby Shell would supply gas to the latter company for delivery into its Southern Alberta gas transmission system. The gas company built a line connecting Jumping Pound with Calgary and Banff.

After the repudiation of oil undertakings by Mexico some years ago and the more recent repudiation by Iran of concessions to Anglo-Iranian with virtual seizure of very valuable properties, we realize that capital needs to examine the political stability of a country into which it enters to make large investment.

Canada has a living standard for the common man that approaches that found in the United States. The farmer is in general well off, and the city of Calgary has a per capita ownership of automobiles exceeded only by Los Angeles. There was hardship in the lean '30's when Social Credit was expounded by the late William Aberhart, who came into power on the promise of monthly dividends of $25 to all adults. Aberhart is dead, but his government lives on (although the dividend was never paid) as one of the most solid governments in the world, solvent largely from oil revenue.

Saskatchewan has a "socialist" C.C.F. (Canadian Commonwealth Federation) government and at one time its slogan was public ownership of all utilities. When the oil industry washed its hands of the province and declined to venture investments there, the government changed its tune and gave solemn guarantees that private capital would be allowed to operate without interference. The spectacular success in Alberta and in North Dakota have encouraged development. The government still hopes to hang on to gas distribution. It took over electrical distribution some years ago.

British Columbia is in an unbalanced political state. Its previous coalition government had been timid, but at least one of the cabinet appeared to have been feathering his nest because of his cabinet post, and last June Social Credit carried the polls by a majority of one seat. A new election has been called for June with the socialist C.C.F. as the main contender. Harold Winch, the C.C.F. leader, has long spouted vitriolic words about big business. He has now resigned as party leader and it remains to be seen what the new C.C.F. policy will be. So far as we can observe, most of the people of the province are reasonably well off and we cannot do more than wait and see, though we do not greatly fear a socialist repudiation of undertakings made in the past.

The Dominion government is on the way to being a welfare state with the baby bonus paying every mother $5 monthly for small children and old age pensions of $40 monthly to everyone 70 and over. Income tax is high, but probably no higher than in the United States, and whichever party wins in the next election, expected next fall, federal undertakings are likely to be honored.

Recently both Provincial and Federal policies have been reaching a more definitive state. First came the Alberta decision to permit the export of Peace River gas. More recently the Hon. J. H. Brockelbank, Saskatchewan Minister of Resources, had enunciated a policy for that Province. He states that any interprovincial line will be allowed to export Saskatchewan gas if it will agree to guarantee a domestic supply to the province in the future at reasonable rates. Failing in such an agreement, exports will be allowed after a minimum reserve of one trillion cubic feet is established. Above this level, 50 percent of reserves may be exported, and above three trillion feet, 75 percent may be exported.

Drill stem tests taken at a Cities Service well near Stettler, Alberta encountered thick gas sands with a high potential yield. Steam is being used here to clean a testing tool. Photo by Anthony Linck for Cities Service.

The Rt. Hon. C. D. Howe, Minister of Trade and Commerce, clarified the continuity of export gas from the Peace River district to the Pacific Northwest when he offered assurances that the Federal Government will honor the Alberta export permit for the full period of the export license. Mr. Howe said: "While the permit is renewable from year to year (under the old Electricity and Fluid Exportation Act, in force since 1907) the Canadian Government accepts the responsibility of providing gas in quantities specified in the license granted under the Electricity and Fluid Exportation Act for the full period of the export license issued by the Province of Alberta, assuming that Westcoast Transmission will live up to its obligation to supply customers in British Columbia."

Mr. Howe also stated it to be the policy of the Federal Government that eastern Canada must be served with gas before additional fuel may be exported.

As mentioned above, Premier Manning of Alberta has said that additional exports from the province will be permitted as soon as it is proven that reserves are adequate.

This, together with the Saskatchewan announcement, may hasten the construction of the proposed $260 million Trans Canada or a similar gas line to Ontario and Quebec.

At this moment, it appears likely that 1953 may be a turning point in Western Canadian gas. It may be the year in which firm policies are fixed which will encourage development of a very large potential, far greater than the 10.5 trillion cubic feet now estimated as a known reserve.

Canada's 1952 wildcats 19.1% successful

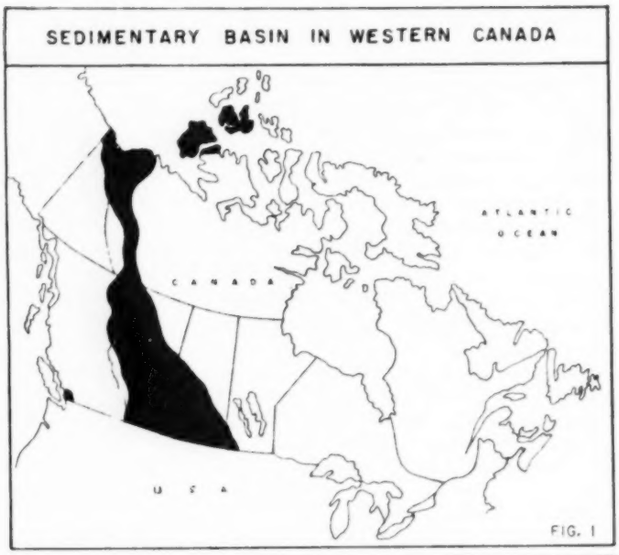
THE SUCCESS RATIO of wildcats completed in Western Canada in 1952 was less than the spectacular 25.9 percent achieved the year before, but remained a satisfactory 19.1 percent. Of the 715 wildcats completed as producers in 1952, 54 were gas wells and 83 oil wells. The record excludes extensions to previously discovered fields.

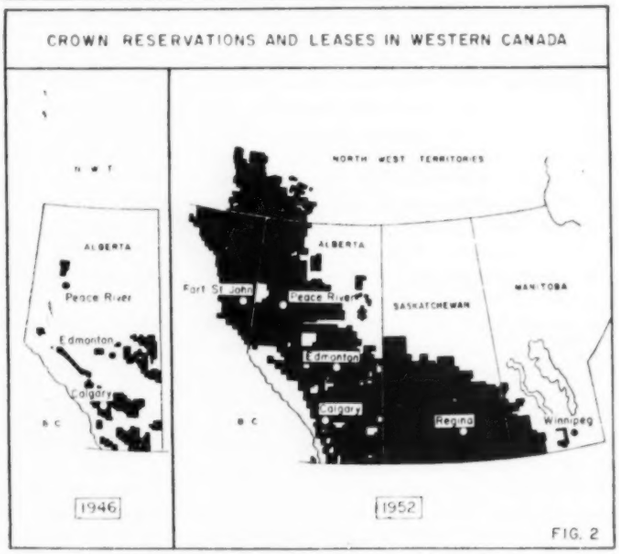
Wildcat drilling activity in 1952 was far greater than in previous years. In 1950 wildcat completions totaled 289, and in 1951 the total was 351. The 1952 record of 715 was an increase of more than 100 percent over 1951. Completed discoveries rose 50 percent.

Greatest percentage growth in wildcatting in 1952 was in Saskatchewan, where the number of completed exploratory wells rose from 51 in 1951 to 248. Success ratio here and in Manitoba was far less than in Alberta where the industry had been working much longer. There was a rising trend, however. In 1950 only 2.63 percent of Saskatchewan wildcats were completed as oil wells. In 1951 this rose to 3.92 percent and in 1952 to 10 percent. In Alberta 12.4 percent of all wildcats were oil wells in 1952 as compared with 10.36 percent in 1951 and 5.88 percent in 1950.

The ratio of gas to oil discoveries changed materially during the year. This may be partly due to the fact that few wildcatters in Western Canada are seeking gas at this time when there is no immediate market in sight except in isolated instances. Whether the record is partly based on more careful selection of drilling prospects or not, the accompanying tabulation shows that gas discoveries in 1952 totaled 54 compared with 59 in 1951, a decrease of nearly 10 percent. Oil discoveries rose 160 percent from 32 in 1951 to 83 in 1952. Last year's crop of oil

(Please turn to page 171)





From address by M. E. Tanner, Petroleum Development in Canada, before the New York Town Hall, March 24, 1953.

TOTAL WELLS DRILLED—INDUSTRY—ALL CANADA—1952

	N. W. T.			B. C.			ALTA.			SASK.			MAN.			WEST. CAN.		
	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total
Oil	—	—	—	—	—	—	937	69	1006	164	44	208	33	7	40	1134	120	1254
Gas	—	—	—	3	7	10	70	72	142	12	13	25	—	—	—	85	92	177
Dry	—	11	11	1	5	6	166	351	517	22	233	255	1	32	33	190	632	822
Total	—	11	11	4	12	16	1173	492	1665	198	290	488	34	39	73	1409	844	2253

	ONT.			N. S.			NFLD.			EASTERN CANADA*			ALL CANADA		
	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total	Dev.	Expl.	Total
Oil	25	3	28	—	—	—	—	—	—	25	3	28	1159	123	1282
Gas	160	8	168	—	—	—	—	—	—	160	8	168	245	100	345
Dry	83	75	158	—	1	—	—	1	—	83	77	160	273	709	982
Total	268	86	354	—	1	—	—	1	—	268	88	356	1677	932	2609

* All Eastern Canada drilling was in Ontario, with the exception of 2 dry exploratory wells, 1 in Nova Scotia, the other in Newfoundland.

SUCCESSFUL NEW FIELD WILDCATS—WESTERN CANADA—1952

ALBERTA

18 OIL

Well Name	Location	Producing Horizon	A.P.I.	I.P. or Test Oil b/d
Albermont Can. Pipe 1	16-34-42-2-4	Blairmore	21	50
Amerada Crown "O" F33-32	7-32-71-25-5	Devonian D3	36	700
Anglo Socony Twining 1	8-9-31-24-4	Madison	39	80 + 113 water
Chamberlain 1	10-30-52-23-4	Blairmore	27	75
Continental Bonnyville 1	16-25-63-5-4	Blairmore	14	66
Gulf C.P.R. Fiveland 4	4-3-46-28-4	Devonian D3	42	1,100
Gulf C.P.R. McAllister 9	9-35-35-20-4	" D2	30	865
Marljoe Elk Point 1	10-19-57-4-4	Blairmore	11	30
Mazal Drumheller 1	12-36-39-21-4	Devonian D2	41	332
Placid Lake St. Anne 1	15-16-55-2-5	Waubamun	23	100
Prado Chauvin 8-28	8-28-43-1-4	Blairmore	23	35
Punch Rio Tinto Red Coulee 1	10-6-1-16-4	"	38	50
Ranchmens Hamilton Lake 1	8-14-35-9-4	Viking	34	70
Sage Meridian Century Kenare Rosenheim 11-20	11-20-37-1-4	Blairmore	12	120
Scurry Expl. Malmo 1	16-10-44-22-4	Devonian D2	39	3,250
		" D3	37	
S. Brazeau Fleetwood Emjay 1	9-12-31-22-4	Madison	12	40
Stanolind Imperial St. Albert Unit	3-1-54-26-4	Devonian D3	34	1,328
Texaco Bonnie Glen A-1	3-20-47-27-4	" D3	43	528

22 GAS

Well Name	Location	Producing Horizon	Gas Mcf/d
Bay Hanna 4-1	4-1-31-16-4	Viking	3,500
Chamberlain Bindloss 1-33	1-33-22-4-4	Bow Island	4,000
Delhi et al Minnehik 1	12-22-46-6-5	Mississippian	14,000
Dome J.V. Consort 13-9	13-9-37-6-4	Viking	3,600
Gordondale 2	11-25-79-11-6	Cadotte	4,000
H.B. Union Eagleshan 1	5-13-77-26-5	Mississippian	5,500
H.B. Union Pacific Dunvegan 3	5-19-81-4-6	Cadotte	1,800
Imperial Belloy 12-14	12-14-78-1-6	Nikanassin	9,600
Imperial Lost Pt. Lake 7-20	7-20-57-23-4	Viking	4,770
Imperial Watt 5-11	5-11-55-14-4	"	3,900
Gulf Lempert 4	4-32-38-22-4	Devonian D2	6,000
Leduc Socony Chancellor 1	16-10-25-21-4	Blairmore	5,500
McColl Union 11-A-19	11-19-1-6-4	Bow Island	2,800
Pacific Gas Expl. Rycroft 1	8-5-77-4-6	Cadomin	4,700
Shell Olds 1	16-11-32-1-5	Wabamun	2,530
Stanolind Cal Standard Pigeon Lake 1	9-14-46-28-4	Devonian D3	10,000
Texaco Merrill Calvan 11-21	11-21-52-19-4	Viking	4,500
Texaco Pacific Dixonville A-1	14-25-86-1-6	Gething	4,700
Union Mellowdale 1	10-21-60-3-5	Viking	5,000
Western Duvernay 27-15	15-27-55-12-4	"	1,600
Western Trinidad Watt L. 27-7	7-27-34-10-4	"	2,500
Zaida 16	16-26-60-24-4	Blairmore	11,500

SASKATCHEWAN

12 OIL

Well Name	Location	Producing Horizon	A.P.I.	I.P. or Test Oil b/d
Canada Southern Buffalo Coulee 1-16	1-16-32-24-3	Mississippian	14	?
Canada Southern Buffalo Coulee 3	6-32-32-24-3	"	14	100
Canada Southern Driver 4	4-29-31-24-3	Viking	33	26-45
Canada Southern Onward 7-10	7-10-34-24-3	Mississippian	14	160
Imperial Tidewater Wapella 9-33	9-33-14-1-2	Blairmore	27	100
Phillips Husky Dewar 1	8-29-30-26-3	Detrital	15	40
Phillips Husky Hoosier 1	13-11-31-28-3	"	16	75
Socony West, Prairie Cantuar 2-14	14-2-16-17-3	Blairmore	23	?
Socony West, Prairie Fosterton 1	2-10-17-18-3	Jurassic	24	250
Socony West, Prairie Midway 1	14-6-15-19-3	"	?	?
Socony West, Prairie Success 3-6B	6-3-17-16-3	"	23	72
Tidewater Eastend Crown 1	15-11-6-20-3	"	21	?

1 GAS

Well Name	Location	Producing Horizon	Gas Mcf/d
Sohio Standard Elrose 1	14-12-26-16-3	Viking	1,000

MANITOBA

4 OIL

Well Name	Location	Producing Horizon	A.P.I.	I.P. or Test Oil b/d
Cal Standard Tilston Prov. 5-32	5-32-5-29-1	Mississippian	33	150
Cal Standard Waskada 9-13	9-13-1-26-1	"	?	?
Pascar Westover 1	1-21-1-27-1	"	35	60
Royalite Triad et al Lulu Lake 1	16-14-1-21-1	"	35	138

BRITISH COLUMBIA

2 GAS

Well Name	Location	Producing Horizon	Gas Mcf/d
Pacific Ft. St. John 4	14-21-83-18-6	Permo-Penn.	29,000
Pacific Peace R. Brit. Dom. 1	13-17-81-17-6	Triassic	3,900

Note: This list shows only actual New Field Discoveries. The Total Indicated New Field Discoveries were:

Alberta	11 oil	12 gas
Sask.	7 oil	2 gas
Manitoba	2 oil	—
Total Indicated	20 oil	14 gas
Add. Total Actual	34 oil	25 gas
Total W. Can. Actual & Indicated	54 oil	39 gas

COMPARISON OF 1950, 1951 AND 1952 WILDCATTING RESULTS

Year		COMPLETED DISCOVERIES Total	Gas	Oil	Rate Gas	Rate Oil	COMPLETED WILDCATS Total	Rate Gas	Rate Oil	% Total
1952										
	Alberta	96	44	52	45.8%	54.2%	418	10.5%	12.4%	22.9%
	Saskatchewan	31	6	25	19.4%	80.6%	248	2.5%	10.0%	12.5%
	British Columbia	4	4	nil	100%	—	11	36.3%	—	36.3%
	Manitoba	6	nil	6	—	100%	38	—	15.7%	15.7%
	Western Canada	137	54	83	39.5%	60.5%	715	7.5%	11.6%	19.1%
1951										
	Alberta	84 (a)	55	29	65%	35%	280	19.64%	10.36%	30.0%
	Saskatchewan	5 (b)	3	2	60%	40%	51	5.88%	3.92%	9.8%
	British Columbia	1	1	nil	100%	—	12	8.30%	—	8.3%
	Manitoba	1	nil	1	—	100%	8	—	12.50%	12.5%
	Western Canada	91 (c)	59	32	65%	35%	351	16.8%	9.1%	25.9%
1950										
	Alberta	32	18	14	56%	44%	238	7.56%	5.88%	13.4%
	Saskatchewan	1	nil	1	—	100%	38	—	2.63%	2.6%
	British Columbia	nil	nil	nil	—	—	7	—	—	—
	Manitoba	nil	nil	nil	—	—	6	—	—	—
	Western Canada	33	18	15	55%	45%	289	6.23%	5.19%	11.4%

(a) includes 7 abandoned gas discovery wells. (b) includes 1 abandoned gas and 1 abandoned oil discovery well. (c) includes dual oil and gas discoveries in total of 64 completed discovery wells.

The first discovery of an Upper Devonian coral reef dual zone by an independent which occurred five years after Leduc, Scurry-Explorers Malmo No. 1.

Dr. Theodore A. Link, president of Link and Nauss Ltd., Calgary and Toronto, is no stranger to readers of WORLD PETROLEUM. *He has contributed significant articles to this journal since the development of Western Canadian fields became active. He has written many papers for his technical societies. In 1949 he was awarded the Barlow Memorial Medal by the Canadian Institute of Mining and Metallurgy for the outstanding paper on geology published that year. Dr. Link served Imperial Oil Ltd and its subsidiaries in Canada and Latin America for 20 years prior to his resignation in 1948 to enter the consulting field. He was chief geologist for Imperial at the time of his retirement from the company.*

WESTERN CANADA'S OIL RESERVES

By Theo. A. Link and John A. Downing

— PART ONE OF TWO PARTS —

John A. Downing has been engaged in the Canadian mining and oil industries throughout his active professional life. His schooling was interrupted for the best part of six years during World War II during which he served in the Royal Canadian Air Force and the Canadian Army both at home and overseas. In 1946 he re-entered Montana School of Mines and was graduated in geological engineering in 1948. Later that year he joined Pacific Petroleums Ltd. as a field geologist. He remained with that company until 1950 when he joined Link and Nauss Ltd., consulting petroleum geologists.—The senior author has requested the editors to note that the junior author, Mr. Downing, did all of the work involved in compiling and assembling this article.

Abstract

During the period beginning with the discovery of oil near Leduc, Alberta, in February of 1947 until the end of the year 1952, Western Canadian oil reserves have increased from 92,600,000 to 2,041,317,000 barrels, which is more than twenty times. Commercial production has been established in reservoirs of the Devonian, Mississippian, Triassic, Jurassic and Cretaceous ages. The two productive horizons of Upper Devonian age account for approximately 84 percent of the total discovered reserves. Sands of Lower Cretaceous age are next in importance.

During this six-year period six major oil pools, with 100 million or more barrels, were discovered. They are, in order of size, Redwater, Leduc, Bonnie Glen, Wizard Lake, Cantaur and Golden Spike. All but the Cantaur field in Saskatchewan are Upper Devonian limestone or dolomite reservoirs. Eight other pools, ranging in size from 25 to 71 million barrels, were discovered during this period, while some 60 other minor pools, ranging in size from 18 million to several hundred thousand barrels, some of which may de-

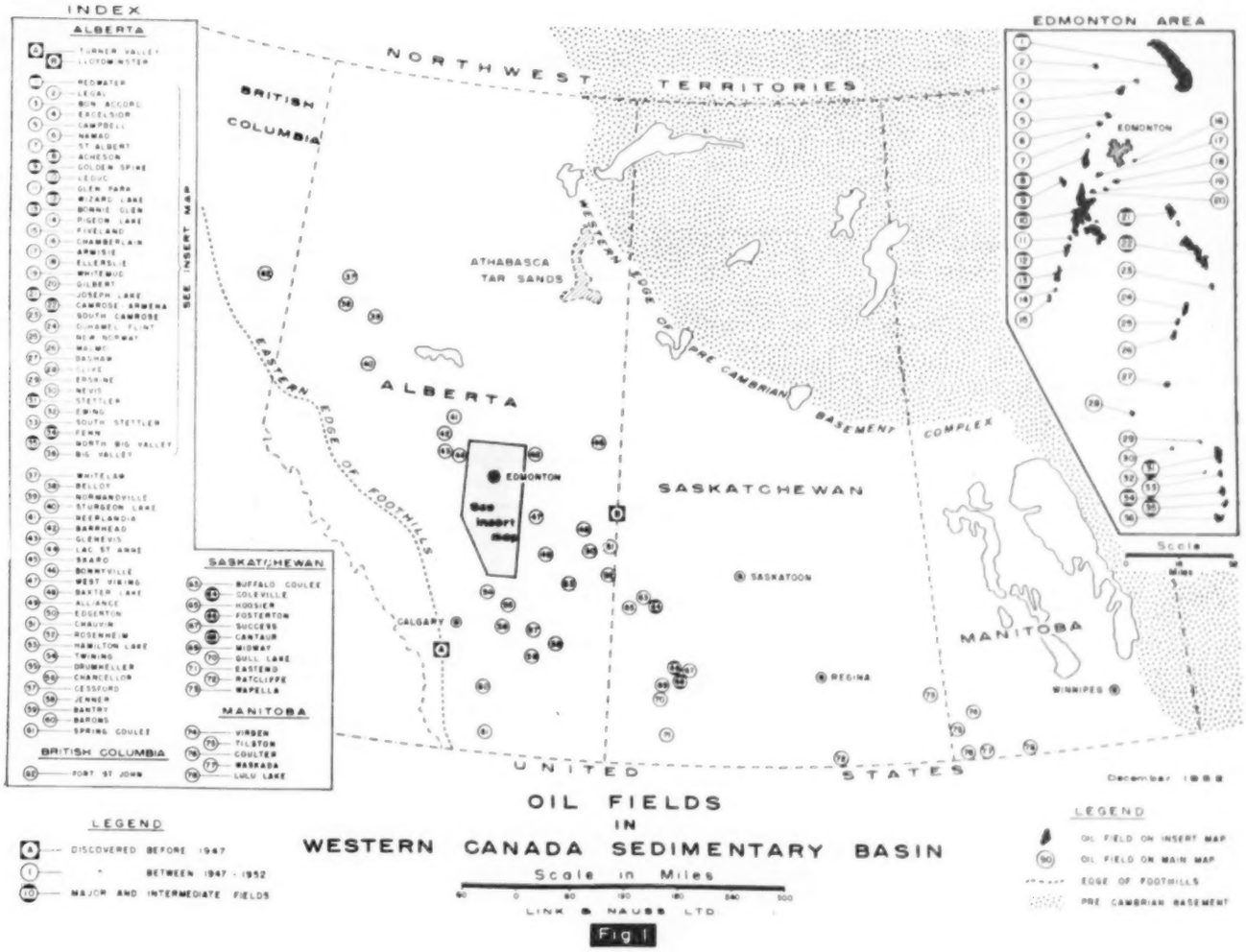


Fig. 1

velop into larger ones, were discovered.

The Province of Alberta accounts for all but one of the major pools, and all but two of the intermediate size pools. Saskatchewan has two fields which account for 40 and 39 million barrels respectively, and in the province of Manitoba there is now one small pool near Virden. No commercial oil has been discovered in British Columbia to date, although large gas reserves (some wet) have been discovered there. The natural gas discoveries and reserves are not discussed in this article.

Reservoir data with respect to the fourteen largest oil pools are submitted with their respective reserve calculations. Some of the lesser pools have been drilled up and their reserves have been calculated, but many are still undeveloped and of unknown size. Reserves for these are merely estimated, and some could eventually develop into larger or even major oil pools. No discoveries made during 1953 are included in the descriptions and calculations.

Introduction

In the six-year period since February of 1947 which marked the discovery of oil at Leduc, Alberta, the recoverable crude oil reserves of Western Canada have increased by more than twenty times. From 1947 to the end of 1952 the industry discovered approximately 2,060,704,000 barrels of recoverable crude oil reserves. In addition to the crude oil reserves, some 60,000,000 barrels of natural gas liquids were added. Western Canada's total recoverable liquid hydrocarbons as of January 1, 1953 stood at 2,041,317,000 barrels. These reserves are subdivided as follows:

	Barrels
Net crude oil reserves before 1947	92,600,000
Net crude oil reserve increase 1947 to 1952	1,883,343,000
Reserve of natural gas liquids	65,374,000*
Total	2,041,317,000

* Canadian Petroleum Association.

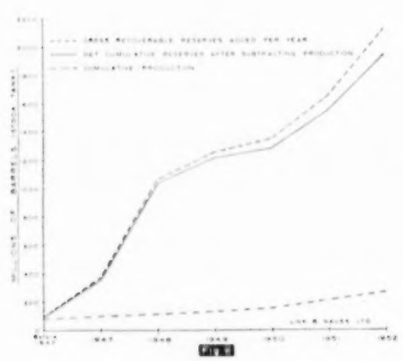


TABLE I
GROWTH OF CANADIAN OIL RESERVES

Year	New Reserves Added	Yearly Production (bbls.)	Increase in Reserves	Cumulative Reserves (bbls.)
Prior '47	178,000,000	85,400,000	nil	92,600,000
1947	277,487,000	7,628,000	269,859,000	362,459,000
1948	693,783,000	12,149,000	681,634,000	1,044,093,000
1949	195,161,000	21,212,000	173,949,000	1,218,042,000
1950	92,773,000	28,378,000	64,395,000	1,282,437,000
1951	346,371,000	47,377,000	298,994,000	1,581,431,000
1952	455,129,000	60,617,000	394,512,000	1,975,943,000

Calculations of the reserves of the larger fields (i.e., fields with more than 20 million barrels reserve) are detailed with a summary of reservoir data and maps. The small fields (i.e., less than 20 million barrels) are listed in a table in chronological order of discovery, and their reserves were estimated where the amount of reservoir data available were not sufficient for calculations. The Turner Valley, Norman Wells, and Lloydminster fields, others discovered before 1947, and natural gas liquids are not described in this report, but their reserves are taken into account where necessary to estimate the total recoverable liquid hydrocarbons.

Discoveries, Production and Cumulative Recoverable Reserves

A comparison of discovered crude oil reserves, production, and the remaining cumulative recoverable reserves is graphically shown in Figure 2. All the calculated recoverable reserves for each field and subsequent extensions are placed in the year in which each field or pool was originally discovered, instead of spreading them over the field's period of development. The increased rate of discovery greatly exceeds the increased production rate. With the completion of the Trans-Mountain Pipe Line to the west, this difference will very shortly be reduced considerably. Practically all the production of crude oil from the new fields has come from Alberta. Production from Saskatchewan will increase considerably in the near future.

The discoveries and production by years and the cumulative reserves are summarized in Table I.

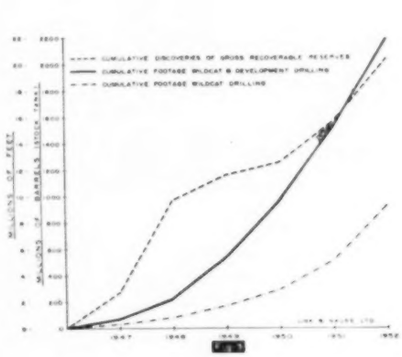
Figure 3 is a graphic comparison of discovered crude oil reserves and the footage of wildcat and development drilling. As one may expect, there is a direct ratio between the cumulative crude oil reserves and the amount of exploratory drilling.

Also of interest is the fact that next to 1948 (during which Redwater, the field with the largest reserves, was discovered), 1952 was the most successful year, with about half a billion barrels added. Figure 3 also indicates that after the Redwater discovery the cumulative wildcat footage drilled curve parallels that of the cumulative discoveries of gross recoverable reserves.

Productive Geological Horizons

Although the Devonian sediments account for the major portion of the crude oil reserves of Western Canada, practically all of the sediments overlying the Devonian contain reservoir rocks. Some of these are the reservoirs for major oil fields, while others, such as the lenticular sands of the Lower Cretaceous, form small but numerous oil pools. Table II summarizes the productive and potentially productive horizons of the geologic column of Western Canada which have been high-lighted in the years 1947 to 1952. Shows of oil and gas have been encountered in sediments underlying the Devonian, but few wells have penetrated through the entire Silurian, Ordovician and Cambrian rock sequences and therefore little is known of their prospects. There is no doubt that sometime in the future the older Paleozoic rocks will be found to contain crude oil and/or gas in commercial quantities.

Figure 3A is a generalized composite stratigraphic column of the sedimentary basin of Western Canada between the Rocky Mountains on the west and the Pre-Cambrian Shield or basement complex on the east. Generally the sediments are thickest in the Alberta Foothills and thin eastward and northward towards the Shield. Variations of this general pattern exist particularly in the northern extension of the Williston Basin. Here the sediments have a maximum thickness in south-central Saskatchewan and thin westward over the Sweetgrass Arch and eastward and northward to the Pre-Cambrian Shield.



Upper Devonian Reservoirs

Of the total oil reserves of Western Canada the D-3 or Leduc member of Upper Devonian age is the reservoir for 1,445,820,000 barrels, or approximately 72 percent. The D-3 is a bioherm or reef development which varies in size, thickness and shape, as might be expected of such an organic deposit. The composition of the rock mass varies between limestone and dolomite, and at times both types are found in the same reef. It is overlain and surrounded by shale so that it is a porous mass surrounded by an impermeable rock, thus forming a stratigraphic trap for oil and other hydrocarbons. In nearly all cases the reefs have steep flanks with slopes approaching 25 degrees, or very nearly the angle of repose. (See Figure 5A, which is a cross-section of the Leduc field).

Several trends have been delineated by drilling and are shown in Figures 4, 5, 9 and 10. Leduc appears to be an intersection of two trends from St. Albert to Woodbend and from the southwestern part of Leduc through Glen Park to Fiveland. This trend appears to continue southwestward to the deeper parts of the Alberta Geosyncline. Other well-defined trends are the narrow reefs of Duhamel—New Norway, Malmo and Stettler—Fenn—Big Valley. These reefs are the reservoir rock for minor pools. (See Figures 8 and 13).

The D-2 or Nisku member of Upper Devonian age is the second ranking reservoir for oil. Its reserves amount to 239,075,000 barrels, or approximately 12 percent of the total. The D-2 zone is a blanket reef or biostrome development, and has an almost uniform thickness which varies between 100 and 240 feet in the general Edmonton area from Excelsior to Big Valley, a distance of over 100 miles. It is composed predominantly of dolomite with vuggy and intercrystalline porosity and interbedded siltstone, shale and some bedded anhydrite. In some fields, notably Leduc and southwest of Leduc, the original porosity has been reduced or almost obliterated by anhydrite infilling.

In most cases the entrapment of oil in the D-2 is the result of structural closure caused by the draping of the D-2 biostrome over a hard core of D-3 reef. In a few cases, notably the southeastern part of the Leduc Field, the trap is believed to be stratigraphic, due to anhydrite infilling. However, in all fields where the D-2 is productive it is known to be underlain by a D-3 reef body.

Cretaceous Reservoirs

The Viking sands of Lower Cretaceous age form the third ranking reservoir of Western Canada. This member extends from the Foothills of Alberta almost to the Manitoba-Saskatchewan border and in addition to being a major reservoir for oil is also a prolific reservoir for natural gas. In the Edmonton area and in parts of western Saskatchewan it is composed of 100 to 150 feet of sandstones and shales. The ratio of sands to shale varies in every locality but generally the sand content decreases in a northeast direction. Local up-dip pinchouts or facies change from sands to shale form stratigraphic

TABLE II

PRODUCTIVE AND POTENTIALLY PRODUCTIVE HORIZONS, WESTERN CANADA

Period	Formation	Field or Pools	Estimated Original Crude Oil Recoverable Reserves (bbls.)
Upper Cret.	Fish Scale Sand	Barons Pool	500,000
Lower Cret.	Viking Sand	Legal, Joseph Lake, Armena-Camrose	101,572,000
	Basal Colorado Ss.	Cessford	5,000,000
	Manville (Colony, Dina, Ellerslie (Basal Quartz etc.)	N. Woodbend, Baxter Lake, Gilbert Plains, Namao, Campbell, etc.	36,300,000
	Roseray, Cantaur Gething	Fosterton, Cantaur, Success	163,500,000
	Cadomin	Fort St. John, B. C.	shows
Cretaceous and/or Jurassic	Nikanassin	Rycroft and elsewhere in Foothills & Peace River	shows
Jurassic	Sandstone and limestone	Midway, Eastend, Wapella	5,500,000
Triassic	Sandstones and carbonates	Whitelaw	1,000,000 and shows
Permo-Penn	Carbonates and sands	Belloy	1,100,000 and shows
Mississippian	Rundle	Spring Coulee, Twining	1,400,000 & numerous shows
	Limestone	Virden, Ratcliffe	2,600,000
	Banff Ss.	Coleville, Buffalo Coulee, Onward	46,837,000
Upper Devonian	D-1 (Wabamun)	Lac St. Anne, West Viking, Leduc etc.	1,000,000 & many shows
	D-2 (Nisku)	Leduc, Excelsior, Malmo, Duhamel, Stettler, Big Valley, etc.	239,075,000
	D-3 (Leduc)	Leduc, Redwater, Golden Spike, Wizard Lake, Bonnie Glen, Acheson, etc.	1,445,820,000
	Duvernay	Three Hills	shows
	Cooking Lake	Skaro, Fort Saskatchewan, Leduc & elsewhere	500,000 & numerous shows
	Beaverhill Lake (limestones)		numerous shows
Middle Devonian	Organic dolomites		shows
Silurian	Dolomites & limestones		minor shows
Ordovician	Dolomites & limestones		minor shows

GENERALIZED COMPOSITE STRATIGRAPHIC COLUMN OF THE SEDIMENTARY BASIN OF WESTERN CANADA

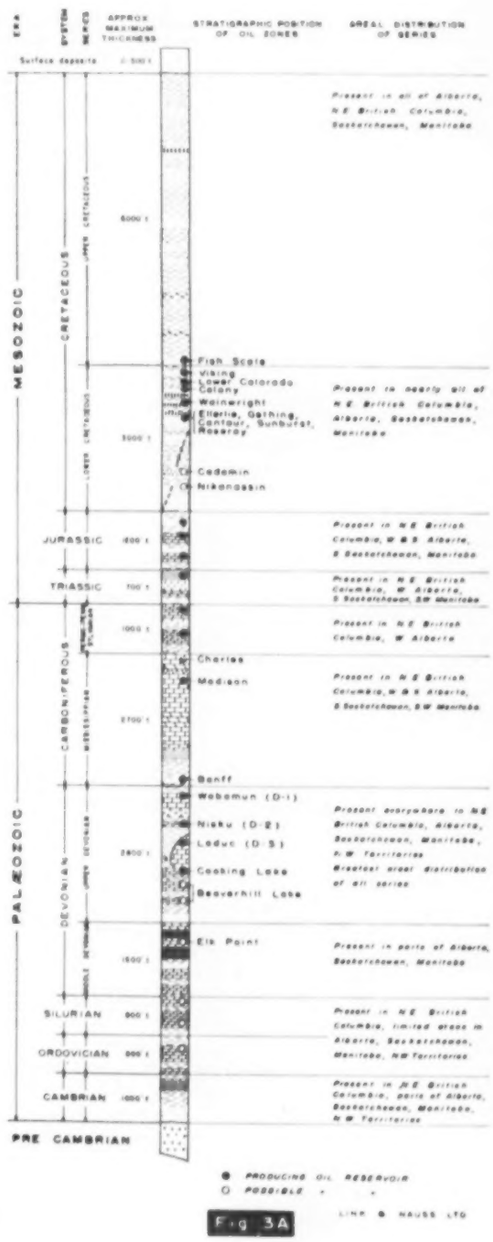


Fig 3A

LINK & NAUSS LTD

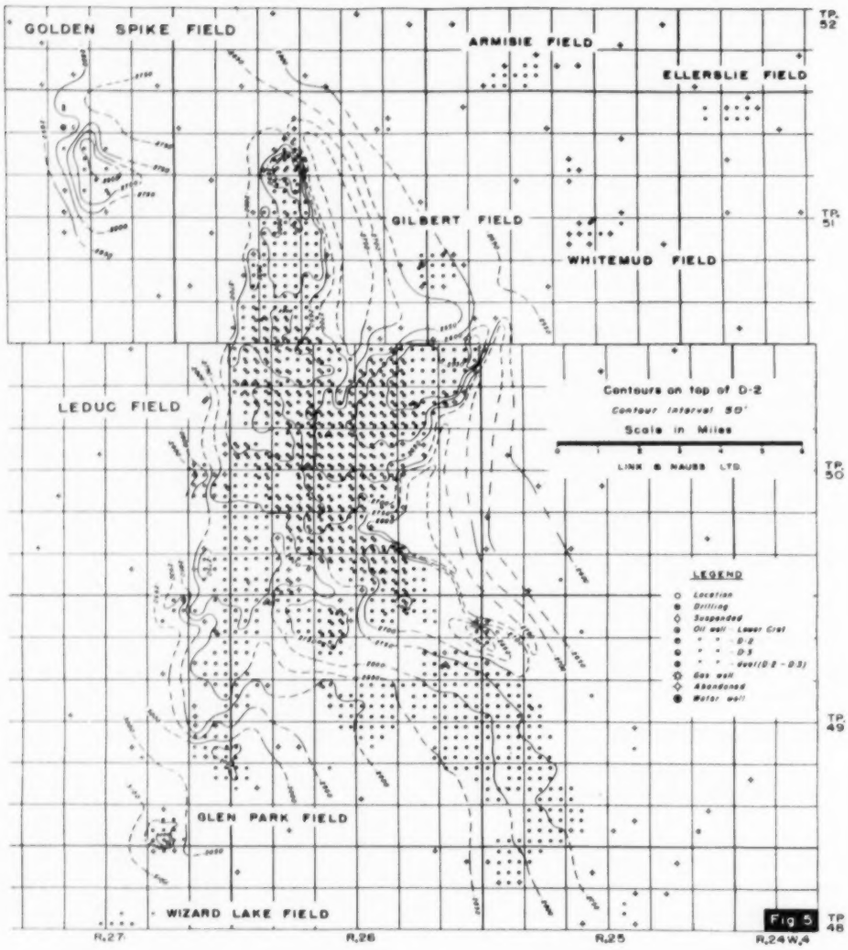


Fig. 5

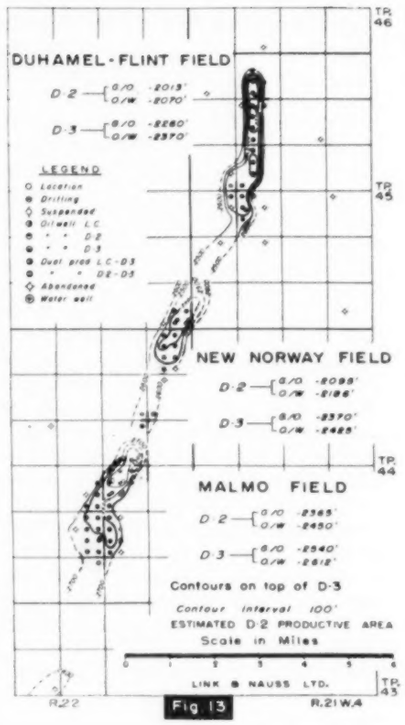


Fig. 13

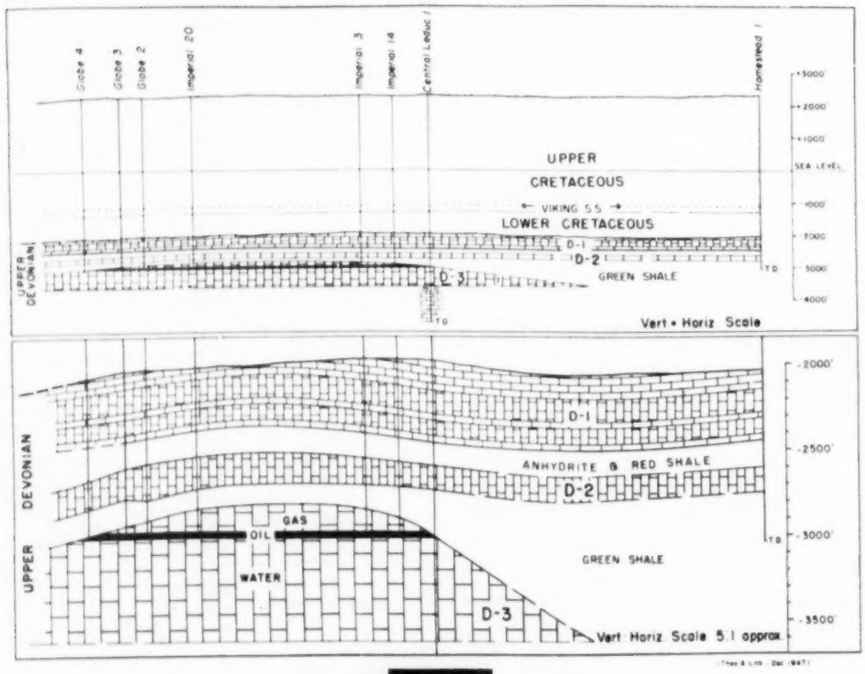
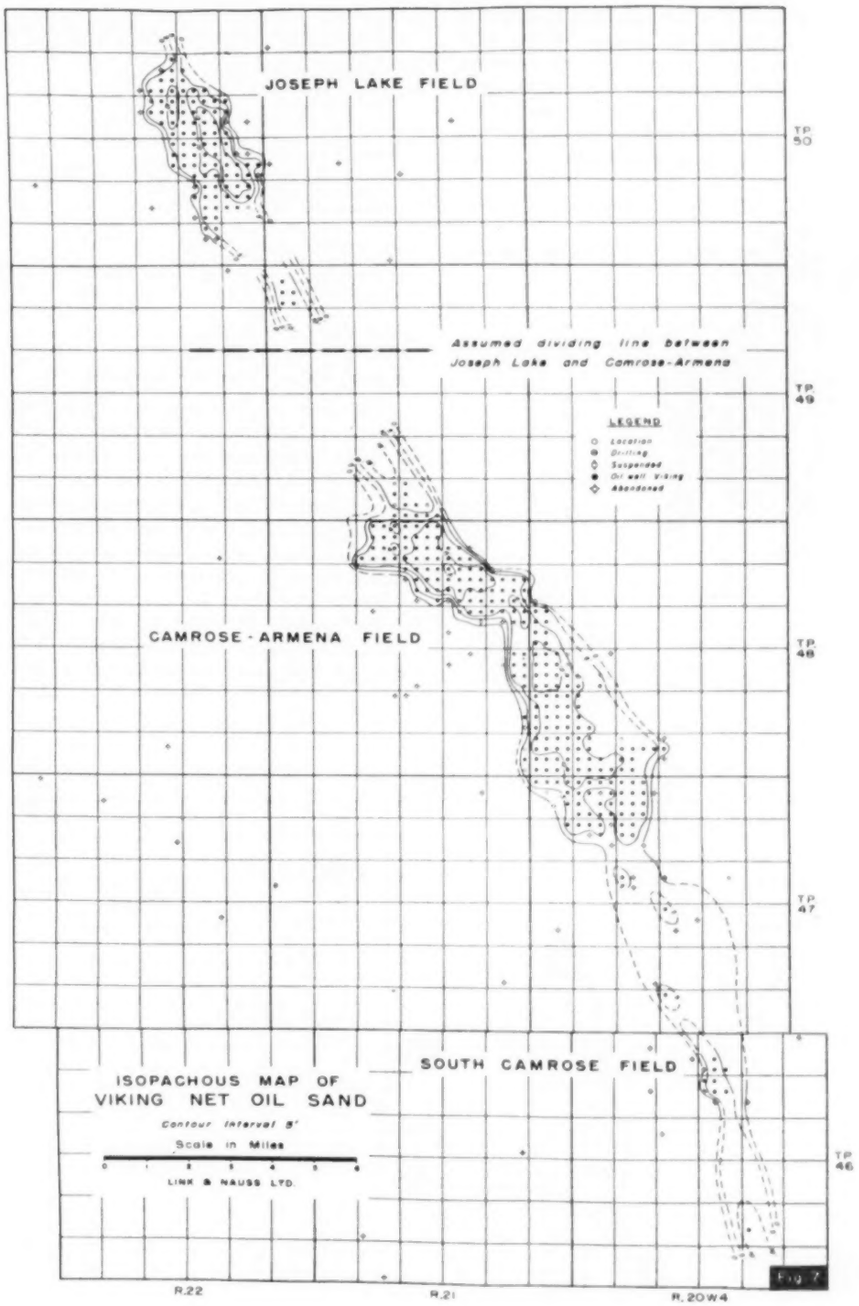


Fig. 5A

traps for oil and gas. The Joseph Lake—Armena—Camrose trend (see Figure 7) is a very good example.

The fourth ranking reservoir rocks are the Roseray and Cantaur sands found in the Swift Current area of southwestern Saskatchewan. The lower or Roseray sand may be Jurassic in age, but for the purposes of this report has been assigned to the Lower Cretaceous. Both members consist of 40 to 60 feet of lenticular porous quartz sandstone. These lenticular sandstones form traps which are believed to be related to Jurassic structural highs. (See Figure 12).

The various sand members of the Manville Formation are the reservoirs for approximately 36,500,000 barrels of oil of varying gravity. This does not include the large heavy gravity oil reserves of Lloydminster and Conrad, Taber and other Lower Cretaceous fields discovered prior to Leduc. Most of this oil is found in the Edmonton area and is usually a light gravity crude averaging 35° A.P.I. gravity. In almost all fields the reservoirs in the Edmonton area are the lenticular sands of the Ellerslie or Basal Quartz Series. The thickness of this member varies depending on the topography of the pre-Cretaceous erosional surface. In the Edmonton area it averages 100 to 150 feet of alternating porous quartz sandstones and dark shales although in some localities, notably St. Albert, it consists of a continuous sand development with a few thin shale beds. Some of these sand fields are associated with the structural conditions caused by an underlying biohermal reef (see Figures 4 & 9); others are due



to a structural condition probably caused by irregularities on the Paleozoic unconformity surface and others are due to an "up-dip" (regional) pinchout of porosity.

Jurassic and Mississippian Reservoirs

Of the remaining formations which have reservoirs for oil, the Jurassic and Mississippian rock units are the most interesting and are receiving a great deal of attention in Saskatchewan and Manitoba. Turner Valley, the first large oil field discovered in Alberta, has produced over 100,000,000 barrels of light gravity oil from the Rundle formation of Mississippian age. The Pincher Creek gas-distillate field discovered after Leduc is also a Rundle accumulation in a Foothills fold. Much more oil will be discovered in this formation in the Foothills of Alberta.

Other Possible Reservoir Horizons

Many of the possible reservoirs in Western Canada have been tested in but a few localities. The Cadomin and Nikanassin conglomerates and sandstones in the western part of Alberta and northeastern British Columbia, and the Cooking Lake and Beaverhill Lake limestones—all have good to fair reservoir characteristics and will eventually produce commercial quantities of oil and gas.

Resume of Major and Intermediate Oil Field Reserves

Fourteen fields account for over 80 percent of these recoverable reserves of crude oil in Western Canada. Of these, six are major fields with reserves of one hundred million barrels or more. All fourteen fields have been discovered since 1947. Eleven of them are in Alberta and the remaining three are in the western part of Saskatchewan. The calculated net recoverable reserves of these fields, based upon current data and development, are as follows:

Field	Producing Formation	Net Recoverable Reserves, Jan. 1952 (after production) (Barrels)
Redwater	D-3	627,254,000
Leduc	D-2	51,468,000
	D-3	169,881,000
Bonnie Glen	D-3	176,672,000
Wizard Lake	D-3	151,868,000
Cantaur	Cantaur and Roseray Sands	114,000,000
Golden Spike	D-3	101,127,000
Armena-Camrose	Viking Sand	71,702,000
Acheson	D-3	59,715,000
Fosterton	Roseray Sand	40,000,000
Coleville	Banff Sand	38,549,000
Fenn	D-2	35,358,000
Stettler	D-2	32,188,000
North Big Valley	D-2	28,940,000
Joseph Lake	Viking Sand	24,068,000

These fields will be discussed in chronological order of their discovery, with the necessary data for their respective reserve calculations and, in some cases, with maps.

Leduc - Woodbend Area

On February 13, 1947, the Leduc No. 1 Imperial Oil Limited discovery well was brought into production with a fanfare unparalleled in the annals of Western Canada's oil history. Government dignitaries, the press, the radio and officials of the company were there to witness this historic event. It marked the beginning of the present Western Canadian oil development which previously had several contributary, but false starts, such as the 1914 "Calgary oil boom" caused by the discovery of light crude and gas from the Lower Cretaceous beds in Turner Valley; the 1924 "Royalite 4" boom which was a distillate and gas discovery in the Madison lime of Mississippian age on the gas cap of Turner Valley; and the "1936 boom" caused by the Turner Valley Royalties No. 1 discovery of crude oil on the west flank of Turner Valley. The crude oil discovery during August of 1920 near Ft. Norman (60 miles south of the Arctic Circle) in the North West Territories gave rise to an oil-lease staking rush in 1921, but no sizeable "boom" resulted, primarily because of its remote distance.

Soon after the Leduc discovery, Imperial Oil Limited drilled a successful producer in the Woodbend area north of the Leduc pool which has since proven to be an extension of that field. The reserve calculations submitted herewith are for the Leduc-Woodbend area and other extensions of the original Leduc pool as indicated in Figures 4 and 5.

Date: January 1953	Field: Leduc-Woodbend (D-2 & D-3)	
Wells	D-2	D-3
Completed	604	472
Ultimate Total (est.)	758	560
Acres/well	40	40
Acreage		
Developed	16,160 acres	18,880 acres
Proved & Semi-proved	30,340 acres	22,380 acres
Oil		
Gravity API	39°	39°
Sulfur	0.29%	
Gas	under-saturated	Gas Cap
Production		
Average Depth	5,000'	5,350'
Producing Formation	dolomite	dolomite
Initial B.H.P.	1760 psig	1884 psig
Present B.H.P.		1775 psig
Gas Oil Ratio	780 cf/bbl.	585 cf/bbl.
Bbls/day	41 economic allowable per well	50,000 for pool.
Reservoir		
Average Net Pay	60'	34'
Average Effective Porosity	3.0%	13%
Average Permeability		300 md.
Average Connate Water, % of Porosity	15%	12%
Shrinkage Factor	0.77	0.685
Reserves		
Est. Oil in Place, (bbls.)	276,700,000	462,471,000
Recovery Factor	25%	45%
Recoverable Oil—bbls/acre-foot	38.0	273.5
Recoverable Oil—bbls/acre	2280	9299
Est. Recoverable Oil, bbls.	69,175,000	208,112,000
Less Produced Oil, bbls.	17,707,000	38,231,000
Net Recoverable Oil, bbls.	51,468,000	169,881,000

Redwater

Imperial Oil Limited made its second and largest discovery at Redwater in August of 1948. The field, which accounts for almost a third of the reserves of Western Canada, produces oil from the D-3 member of Upper Devonian age. In contrast to the Leduc, Wizard Lake and other reef fields, the Redwater oil pool occupies only a fraction of the total volume of the Redwater reef. The reef is believed to have an area of approximately 300 square miles as opposed to approximately 58 square miles for the pool. The reef has a thickness of 600 feet as opposed to an average thickness of 96 feet for the pool. The field, Canada's largest, is almost completely developed, and is the major contributor to Alberta's production. The pressure has decreased from an initial B.H.P. of 1,050 psig to an average of 786 psig. A pressure differential of 140 psi exists between the north and south ends of the field. It is obvious that a strong water drive exists because of the high production per pound drop of pressure. It is likely a pressure maintenance program will be instituted in the near future. The following are the pertinent reservoir data for the Redwater Field. (Also see Figure 6).

Date: January 1953	Field: Redwater
Wells	
Completed	926
Ultimate Total (est.)	931
Acres/well	40
Acreage	
Developed	37,040
Proved & Semi-proved	37,240
Oil	
Gravity API	35.5°
Sulfur	0.5 to 1%
Gas	under-saturated
Production	
Average Depth	3,100'
Producing Formation	D-3 (limestone)
Initial B.H.P.	1050 psig.
Last Recorded B.H.P.	880-740 psig.
Saturation Pressure	485 psig.
Bbls/day	120 MPR Per Well
Gas Oil Ratio	135 cf/bbl.
Reservoir	
Average Net Pay (Max. 205')	96'
Average Effective Porosity	6.65%
Average Connate Water, % of Porosity	15%
Shrinkage Factor	0.88
Average Permeability	800 md.
Reserves	
Estimated Oil in Place, bbls.	1,379,966,000
Estimated Recovery Factor	50%
Recoverable Oil—bbls/acre foot	193'
Recoverable Oil—bbls/acre	18,528
Estimated Recoverable Oil, bbls.	689,983,000
Less Produced Oil, bbls.	62,729,000
Net Recoverable Oil, bbls.	627,254,000

Joseph Lake - Armena - Camrose

The team of New Superior, Kroy and Jupiter Oils, together with Imperial Oil Limited, discovered the first Viking oil field in Western Canada. It was discovered in February of 1949 and has since proved to be a part of a Viking sand field which stretches from Joseph Lake to at least South Camrose, a distance of 30 miles as indicated in Figure 7.

The second discovery of this Viking trend was made by Anglo-Canadian in January of 1951 near the south end of the

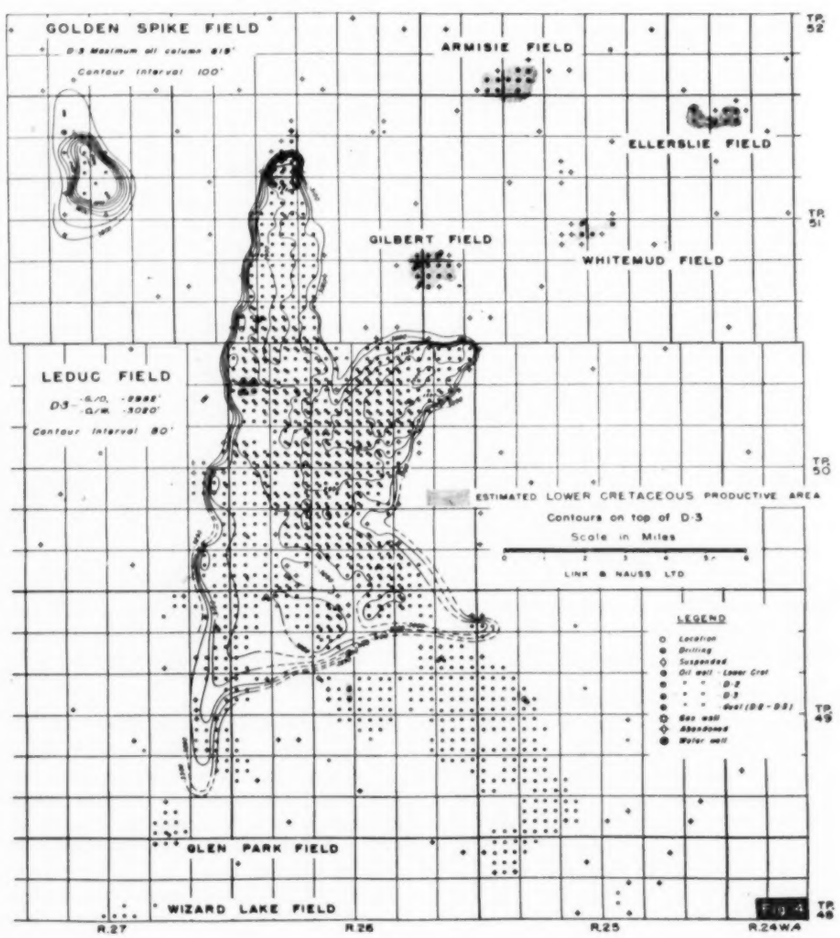
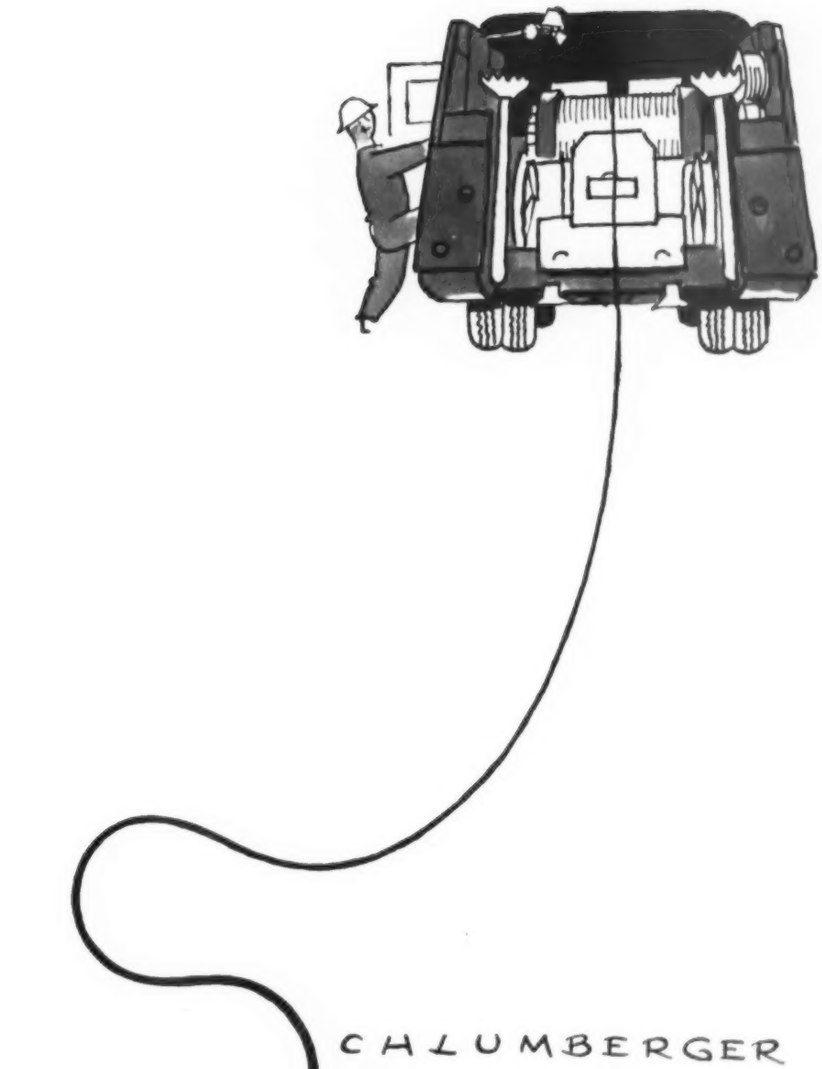
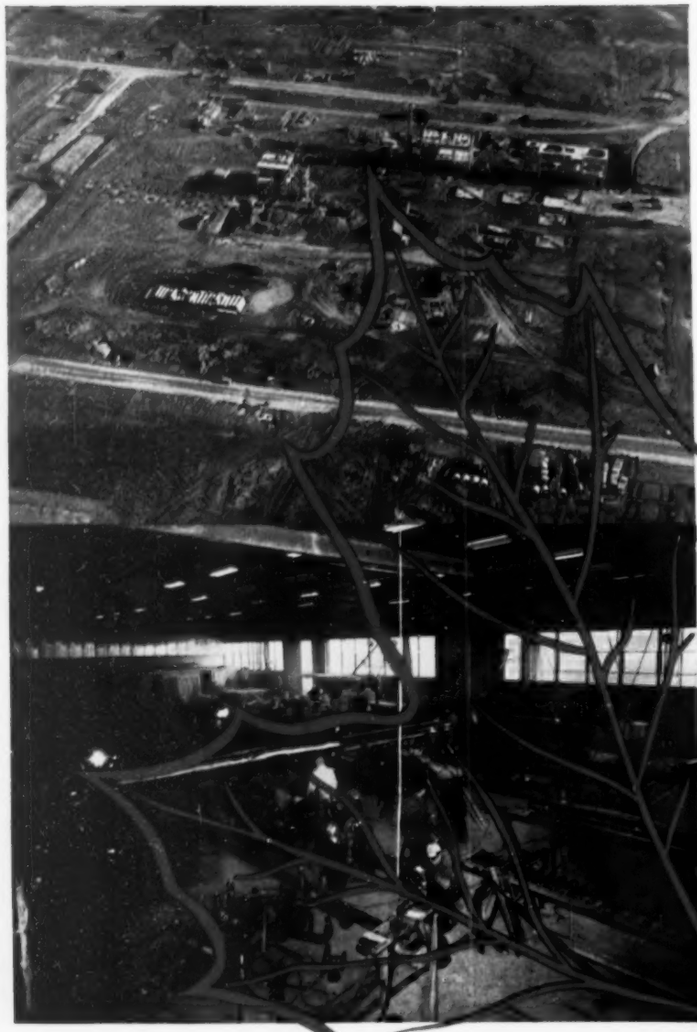


Fig 4



Schlumberger Well Surveying Corp. • Houston, Texas



SUN . . . . Rises in the North

Sun Oil Company, Ltd., has been serving Canada since 1923. The company's decision to construct its first Canadian refinery—a multi-million dollar project to develop a capacity of 15,000 b.p.d. of crude oil—reflects the vast industrial development taking place in the Land of the Maple Leaf . . . Selection of a 200-acre site in Sarnia, Ontario, for this important unit reflects the significance the great "Chemical Valley" holds for the future . . . And the selection of Catalytic Construction Company to handle this large engineering-construction project through its Canadian subsidiary reflects the Sun company's appreciation of the value of Catalytic's "on-time—on-budget" service to modern engineering. It is an experience which Sun and other great companies have shared with satisfaction.

1. January, 1953 . . . Combination unit which will produce high quality gasoline, kerosene, domestic heating oil and residuals begins to take form.
2. February . . . and the pipe fabricating shop was producing equipment at fabulously high speed . . . and fabulously low cost . . .
3. . . . while steelwork began climbing . . . and the derricks were swinging . . .
4. . . . supplies which will have the project completed by the summer of 1953 . . . carrying forward the record of—

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Armena-Camrose Field and was followed by a third discovery by Western Homestead in October of 1951 in the Armena area. The Joseph Lake, Armena-Camrose and South Camrose fields all produce oil from the Viking sand. The trend consists of porous sand lenses which pinch out in an "up-dip" direction providing a permeability barrier for the entrapment of hydrocarbons. The oil is overlain by gas and underlain by water. The oil/water contacts vary from —803 in South Camrose to —736 and higher in Joseph Lake. The pertinent reservoir data for Joseph Lake and Armena-Camrose follow.

Date: January 1953	Field: Joseph Lake
Wells	
Completed	91
Ultimate Total (est.)	167
Acres/well	40
Acreage	
Developed	3,640 acres
Proved and Semi-proved	6,680 acres
Gas	Gas Cap
Production	
Average Depth	3,200'
Producing Formation	Viking Sandstone
Initial B.H.P.	840 psig.
Present B.H.P.	814 psig.
Gas Oil Ratio	600 cf/bbl.
Bbls./day	50 MPR Per Well
Oil	
Gravity API	36°
Sulfur	0.16%
Reservoir	
Average Net Pay	9'
Weighted Average Effective Porosity	21%
Weighted Average Connate Water, % of Porosity	25%
Shrinkage Factor	0.885
Reserves	
Estimated Oil in Place, bbls.	64,997,000
Recovery Factor	40%
Recoverable Oil—bbls/acre foot	432.5
Recoverable Oil—bbls/acre	3892
Estimated Recoverable Oil, bbls.	25,999,000
Less Produced Oil, bbls.	1,931,000
Net Recoverable Oil, bbls.	24,068,000

Date: January 1953	Field: Armena—Camrose
Wells	
Completed	203
Ultimate Total (est.)	365
Acres/well	40
Acreage	
Developed	8,120 acres
Proved and probable	14,600 acres
Oil	
Gravity API	36—38°
Sulfur	0.1%—0.266%
Gas	Gas Cap
Production	
Average Depth	3,200'
Producing Formation	Viking Sandstone
Initial B.H.P.	Camrose—870 psig., Armena—845 psig
Gas Oil Ratio	300 cf/bbl.
Bbls./day	50 MPR Per Well
Reservoir	
Average Net Pay	12'
Average Effective Porosity	18%
Connate Water, % of Porosity	25%
Shrinkage Factor	0.885
Reserves	
Estimated Oil in Place, (bbls.)	162,384,000
Recovery Factor	45%
Recoverable Oil—bbls/acre foot	417.1
Recoverable Oil—bbls/acre	5005
Estimated Recoverable Oil, bbls.	73,073,000
Less Produced Oil, bbls.	1,371,000
Net Recoverable Oil, bbls.	71,702,000

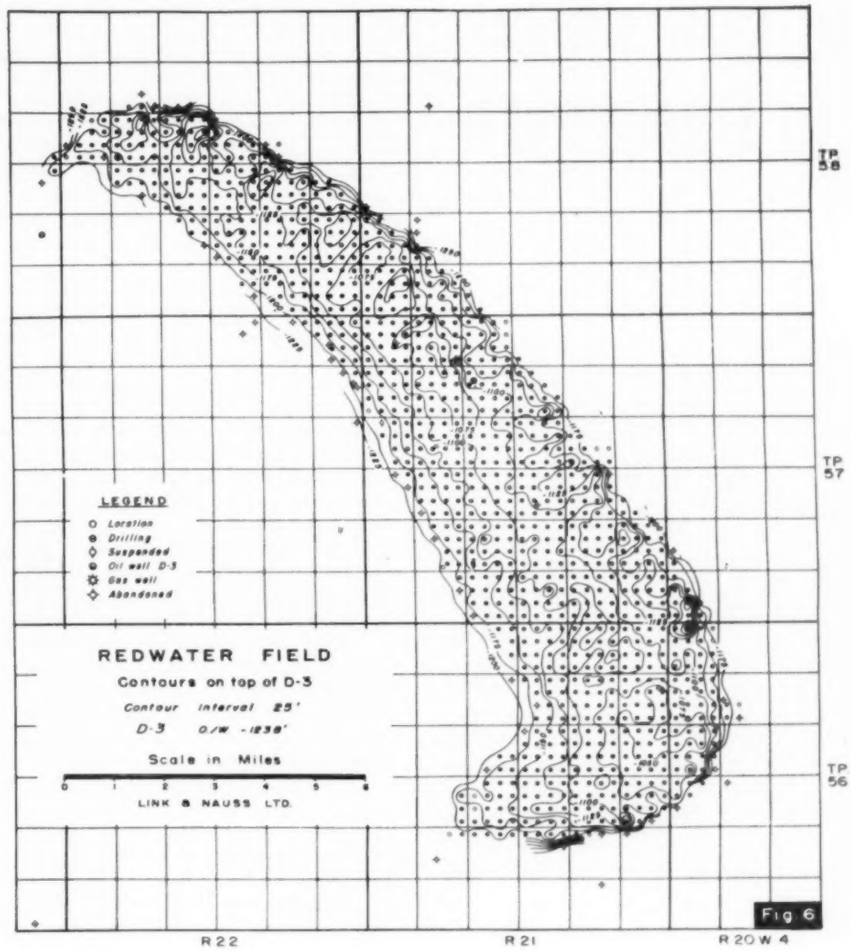


Fig. 6

Golden Spike

The Golden Spike Field, discovered in April 1949, was the third large discovery for Imperial Oil Limited and the first discovery of the "pinnacle" type bioherm. The reef is of a small areal extent—1,100 acres—but its entire thickness of over 600 feet is oil pay. It is the only D-3 field found to date which has not an active water drive. The gas solution drive and gravity drainage are being augmented by an artificially created gas cap. The following tabulation shows the reservoir data for this field. (Also see Figures 4 & 5).

Date: January 1953	Field: Golden Spike
Wells	
Completed	8
Ultimate Total (est.)	8
Acres/well	160
Acreage	
Developed	1,100
Proved & Semi-proved	1,100
Oil	
Gravity API	38°
Sulfur	0.43%
Production	
Average Depth	5,950'
Producing Formation	D-3 (limestone)
Initial B.H.P.	2085 psig.
Last Recorded B.H.P.	1570 psig.
Bbls/day	17,000 MPR for pool
Recovery Mechanism	Artificial pressure maintenance—gas injection
Gas Oil Ratio	330 cf/bbl.
Reservoir	
Average Net Pay (Max. 61')	44'
Average Effective Porosity	9%
Average Connate Water, % of Porosity	20%
Shrinkage Factor	.765
Reserves	
Estimated Oil in Place, (bbls.)	206,764,000
Recovery Factor	50%
Recoverable Oil—bbls/acre foot	213.6
Recoverable Oil—bbls/acre	93,984
Estimated Recoverable Oil, bbls.	103,382,000
Less Produced Oil, bbls.	2,255,000
Net Recoverable Oil, bbls.	101,127,000

Space limitations have made it necessary to divide this report into two parts. Part II will appear in the June issue. It will be noted that in a few instances the authors refer in Part I to maps which will be published in Part II. Editor.

Geological and geophysical reconnaissance technicians in northern Canada are using air transportation to reach difficult terrain. Imperial Oil Ltd. photo.

CANADIAN AND U. S. CAPITAL created billion dollar industry in five years

RAPID GROWTH of the Canadian oil industry since Leduc has required the investment of more than $1,300 million in new capital funds in addition to the money eArned and reinvested.

In return for this great outlay of money, the industry has built a known reserve of 1,700 million barrels of crude oil and natural gas liquids and a reserve of more than ten trillion cubic feet of natural gas. Pipe line mileage has been increased five-fold from 435 miles at the end of 1947 to 2,561 at the end of 1952. Refining capacity has grown 166,000 barrels to 411,850 b/d at the end of 1952. Natural gasoline output has been largely increased and a good start has been made in the formation of a petrochemical industry.

During the five years from December 31, 1947 to the end of 1952, the Canadian industry produced 172 million barrels of crude oil valued at $480 million. Production will rise sharply when new pipe lines are laid and refineries completed, but the industry will not be in the black for some time to come.

Capital requirements for further expansion have been estimated at $250 to $400 million per year for several years to come. Refinery construction is costing $50 million yearly, drilling and exploration $300 million. This year's bill for pipe line construction is $183 million and this sum may be reached again in 1954 if major gas line construction is approved by various government bodies in the United States and Canada.

With a high success ratio since Leduc, the cost of finding oil in Canada has not been as high as in many parts of the world. About $875 million has been spent in six years to produce 190 million barrels of crude and to build known reserves totaling 1,700 million barrels. Cost per barrel of oil discovered has been on the order of 47 cents per barrel, with 10 trillion cubic feet of gas left over.

The Dominion Bureau of Statistics in Canada has made a detailed study to show the ownership of the oil industry in Canada as of 1945 and the changes which took place in the following five years up to December 31, 1951. Data was assembled by the Balance of Payments sec-

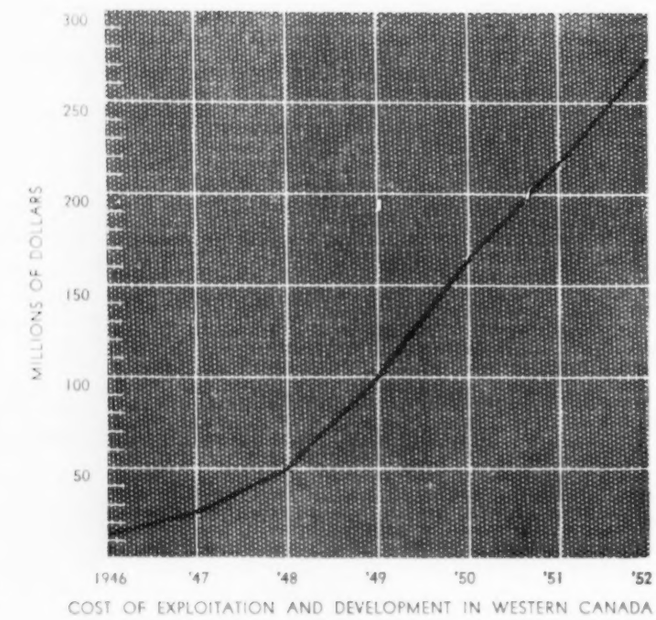


Fig. 1: Cost of exploitation and development in western Canada increased more than $50 million in 1952.

Fig. 2: United States investment in the Canadian oil industry has increased rapidly since Leduc.

tion of the Bureau which has maintained extensive records of international flow of capital. The records cover all companies in which there is a significant ownership by non-residents.

At the close of 1945, it was found that the petroleum industry of Canada had a book value of $296 million. Of this, $172 million or 58 percent was owned by Canadians, $115 million or 39 percent by citizens of the United States, and $9 million or three percent by citizens of the United Kingdom and other countries.

Five years later the industry had a book value of $1,225 million, a net increase of $929 million after all charges for depreciation, depletion and amortization. Canadian ownership at the end of 1951 was $578 million, United States $636 million, the United Kingdom and other countries $11 million. Canadians owned 47 percent of the industry, U. S. citizens 52 percent and others one percent. The proportion of Canadian ownership shrank 11 percent during the five years, while the U. S. share rose 13 percent and others dropped two.

Investment in Canada by companies controlled in the United States totaled $556 million at the end of 1951. This was 45 percent of the industry. Five years previously American-controlled companies had an investment of $96 million or 36 percent of the total. The remainder of the investment in Canadian oil by United States citizens was in companies controlled in Canada. This amounted to $80 million at the end of 1951.

Canadians had an investment in United States oil companies operating in Canada aggregating $197 million at the end of 1951. They owned an interest totaling $381 million in Canadian oil companies. Citizens of other countries had an investment of $6 million in companies operating in Canada, but controlled in the United States. Their investment in companies controlled in the United Kingdom and other countries was $5 million.

An analysis by branches of the industry reveals that Canadian-controlled companies dominate Dominion transportation and marketing functions. In the case of exploration and development, Canadian controlled companies have 53 percent of the net investment. Only in refining do United States companies have a preponderant share. Of the $689 million invested in Canada in 1951 by refining companies, the United States interest totaled $546 million or nearly 80 percent, and the Canadian interest $143 million.

As mentioned previously, the book value of oil company investment in Canada showed a net increase of $929 million in the 1946-51 period. Of this increase, $406 million was in Canadian companies, $521 million in United States companies, and $2 million in other foreign companies.

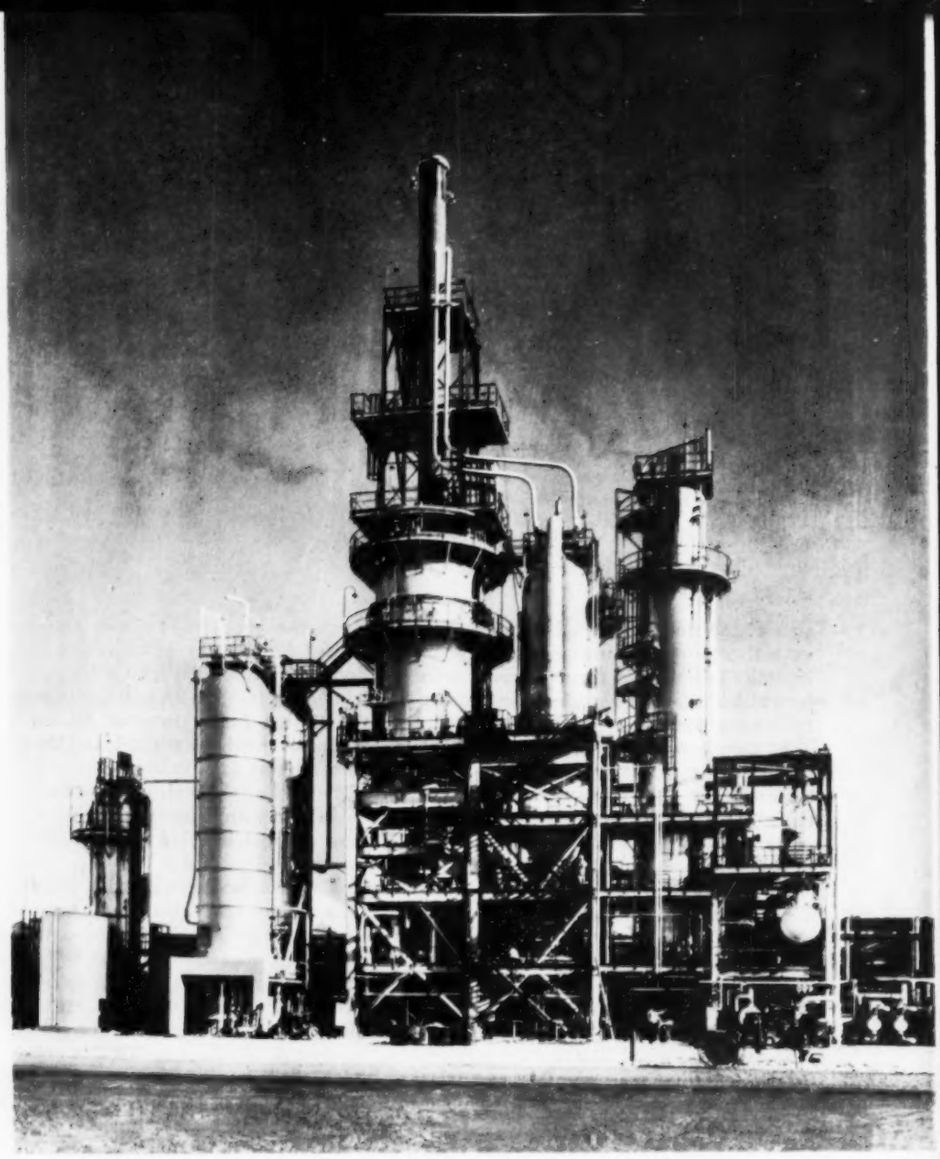
Net inflow of capital from the United States to Canada has been accelerating in recent years. In 1951 alone the inflow was $221 million, or roughly 41 percent of the five-year total. Data for 1952 is not available, but it has been estimated that the figure was at least $300 million. The 1953 investment will be equally large.

In the 1946-51 period, 35 percent of the net inflow of United States capital into Canada was invested in oil. The U. S. Department of Commerce has reported that U. S. net investment in Canada in the first half of 1952 was $510 million compared with $469 million in the same period in 1951. The Dominion Bureau of Statistics reports net capital inflow into Canada for all purposes in 1950 at $960 million and at $560 million in 1951. That year oil represented almost 40 cents of every dollar invested. The present premium price of the Canadian dollar is a result of this inflow. This year it has been estimated that the trend will be reversed. This reversal, if it eventuates, will be in other lines than oil because it is clear that the capital demands for current expansion of this industry in the Dominion are in excess of the funds available for investment from Canadian sources alone.

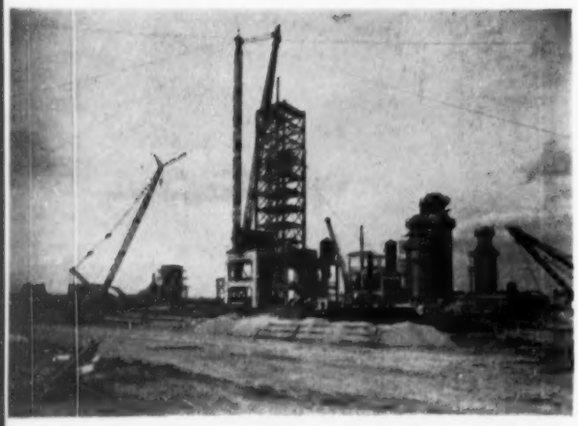
Banking and government leaders in Canada hail the development of substantial oil reserves in the Dominion as an event of great significance to the welfare of the nation. Great benefits have been achieved thus far and even greater benefits will be seen in the future balance of international payments, exchange rate and rate of capital investment, both domestic and foreign.

In some areas oil operators must build many miles of road before drilling can commence. Photo by Fritz Henle for Cities Service Co.

Alberta cities have become boom towns in recent years. Many fine office and business buildings have been erected. Pictured by Anthony Linck for Cities Service Co. is the Petroleum Building in Calgary.



First of the new Type IV fluid cat crackers in the world recently went on stream at the Edmonton, Alberta, refinery of Imperial Oil Ltd. More of the same type are nearing completion at Sarnia. Photo courtesy Foster-Wheeler Ltd.



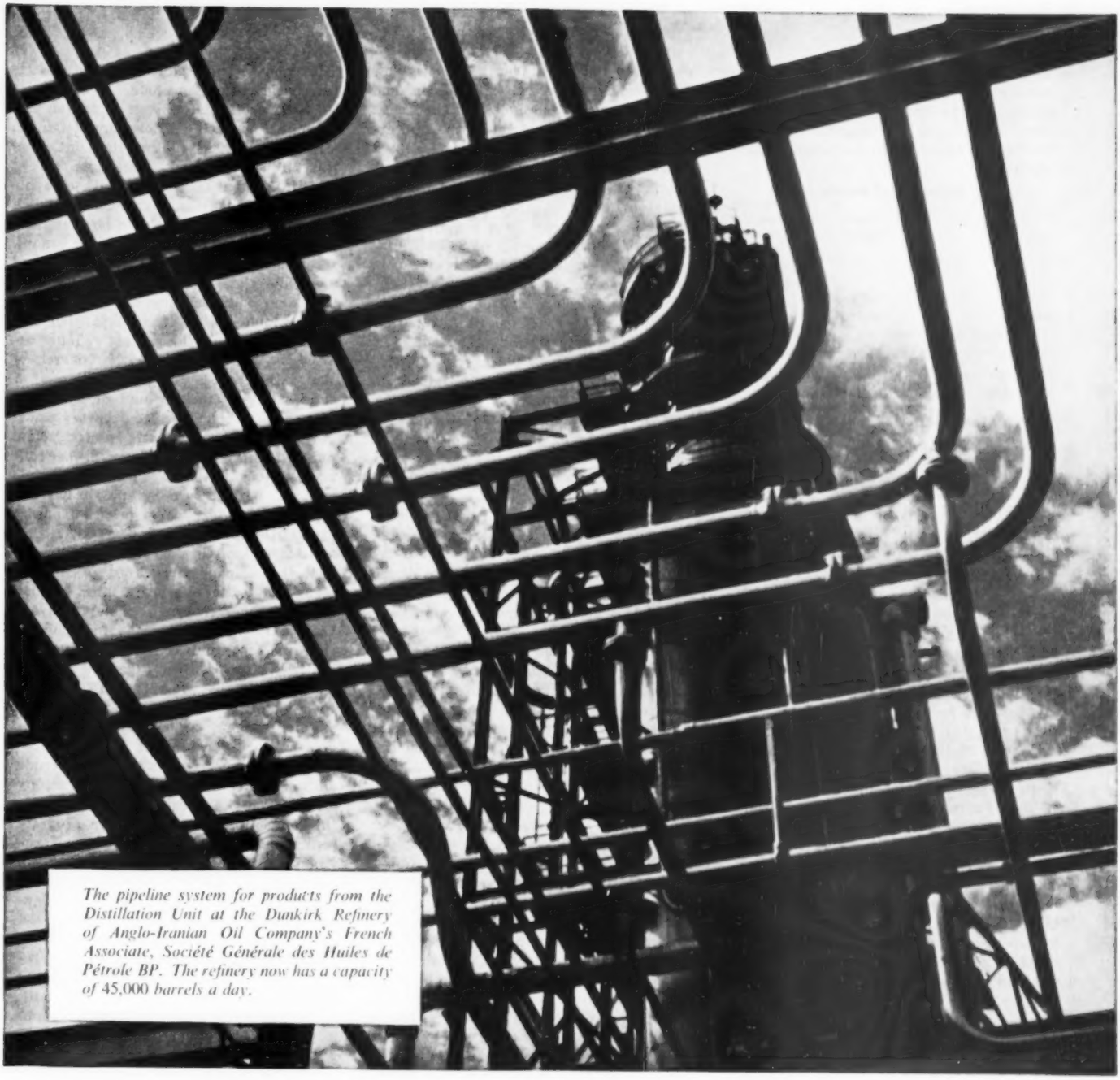
Construction work on Sun Oil Company's new refinery at Sarnia is proceeding on schedule. Shown is progress on the 11,500-barrel Houdriflow catalytic cracker.

ONTARIO AND BRITISH COLUMBIA CENTERS OF REFINERY ACTIVITY

CRUDE OIL CAPACITY of all Canadian refineries was increased 39,000 barrels in 1952 and at the end of December stood at 449,700 barrels daily. Capacity deficiency in the Dominion during 1952 was about 76,000 b/d. Since the end of the year, other projects have gone on stream to increase capacity substantially and by the end of 1953 the Dominion will be able to process about 519,000 b/d of crude, an increase of 69,000 barrels. Capacity will have increased 125 percent since the end of the war. The expansion trend will continue through 1954 with an addition of another 50,000 barrels of capacity in sight. This figure undoubtedly will be augmented as new projects are announced.

In recent years domestic demand for petroleum products in Canada has been increasing at the rate of about 14 percent per year. In 1952 this dropped to about 12 percent and economists are inclined to think that the rate of rise will continue to level off somewhat, perhaps to seven percent in 1953 and 1954. If this should take place, Canadian refiners will be able to catch up with demand and reduce the volume of imported products to a nominal figure.

Since the war, the industry has found it necessary to increase both refined and



The pipeline system for products from the Distillation Unit at the Dunkirk Refinery of Anglo-Iranian Oil Company's French Associate, Société Générale des Huiles de Pétrole BP. The refinery now has a capacity of 45,000 barrels a day.

ANGLO-IRANIAN OIL COMPANY, with its subsidiary and associated concerns, is one of the major units of the world petroleum industry.

Its principal sources of crude oil production are in the Middle East. Through its prospecting subsidiary, the D'Arcy Exploration Company, it is interested in oil-bearing territories in many other parts of the world.

The Company operates refineries in Great Britain, Australia, France, Belgium, Germany, Italy and Israel. Distribution and marketing of oil products are effected both by the Company itself and through various associated companies.

For sea transport its shipping subsidiary, the British Tanker Company, operates one of the largest fleets of ocean-going tankers.

The Company's principal research establishments are in Great Britain, at Sunbury in Middlesex, and at Kirklington in Nottinghamshire.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

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LIMITED

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crude imports year after year despite the rapid expansion of still capacity. In 1952 crude imports dropped one million barrels, but refined oil imports continued climbing as indicated in the following tabulation:

Thousands of Barrels

Year	Crude Imports	Refined Oil Imports (Approx.)
1947	69,077	16,500
1948	77,634	19,000
1949	75,681	13,000
1950	80,124	20,000
1951	83,000	23,000
1952	82,000	28,000

The race which refiners have been running to overtake demand and build a reasonable surplus in rated capacity is indicated in the following tabulation:

Thousands of Barrels Daily

Year	Domestic Demand	Refinery Capacity Jan. 1	Capacity Added In Year	Refinery Capacity End of Year
1949	313.5	315	22	337
1950	357.9	337	22	359
1951	410.7	359	52	411
1952	460	411	39	450
1953	495*	450	69	519

*Estimated

Development of production in the Prairie Provinces has had a profound effect on the location of Canadian refinery capacity in the past few years. Early post war construction centered in Montreal because of the necessity of importing foreign crude to supply 90 percent of Dominion demand. The industry was static on the west coast, the Prairies and in Ontario.

Because of the transportation problem, Prairie refinery capacity was the first to be enlarged after Leduc. At the end of 1947 Prairie capacity was 44,000 b/d, far below local demand. In the five years since then, capacity on the plains has increased more than 200 percent to 135,000 b/d.

Ontario refining was static from 1945 to 1949. The Interprovincial pipe line to Superior, Wis., offered a new stimulus, so that 20,000 barrels of new capacity went on stream in 1951, when Canadian Oil Companies completed its new plant at Sarnia. Since the first of the year, Imperial has completed its current program at Sarnia to add 14,000 b/d of still capacity and Sun Oil Co. is making progress on its new 15,000 b/d plant. Capacity now is 50 percent larger than before Leduc and it seems logical to assume that this trend will continue when the Interprovincial extension is completed and an uninterrupted year-around supply of crude is available for processing. Interprovincial management obviously anticipates this since its extension to Sarnia from Superior will have an ultimate capacity of 300,000 b/d, more than double the still capacity now operating or announced for construction.

Ontario is a logical spot for refinery development because of its population density and industrial development. In 1951 Ontario had 42 percent of the nation's automotive vehicles, consumed 37 percent of the gasoline, 40 percent of the lubricating oil, 33 percent of the grease and 26 percent of the fuel consumed in the entire Dominion. It had at that time less than 20 percent of Canada's refinery capacity.

Because of its isolation, British Columbia has not developed its oil manufacturing facilities until now. This is to be changed by the completion of the Trans Mountain pipe line later this year. In preparation for this pipe line supply of Prairie crude, Imperial and Shell are spending $23,500,000 for refinery expansion, and British-American Oil Co. has purchased a refinery site. By the time the Trans Mountain pipe line is ready to make deliveries, the capacity of British Columbia plants will have risen from its present level of 28,350 b/d to 45,850 b/d. This is approximately in line with current demand. Estimate for 1953 on a crude basis is 42,000 b/d. For 1955, crude requirements are placed at 45,300 b/d and in 1960 at 50,600 b/d. Across the international boundary in Washington and Oregon, a large market exists which is not currently supplied by local refineries and a substantial refining industry is expected to be developed in the state of Washington so that coastwise shipments from California can be reduced. General Petroleum Corp. already has begun construction of a 35,000 barrel plant at Ferndale, Wash., which will be supplied by Canadian crude. Other interests have purchased sites and are expected to announce projects of considerable magnitude.

Work on the $10 million expansion program at the Shell Oil Company of Canada Ltd. refinery at Shellburn, British Columbia, is moving ahead on schedule.

Two storage tanks, each with a capacity of 54,000 barrels, have been completed, the first of six new tanks to be constructed for the storage of gasoline and gas oil. A good deal of the excavation work has been done and construction of the new two-story office building has begun.

The multimillion dollar expansion will more than double the present refining capacity, bringing it to 15,000 barrels a day. Included is the construction of a fluid catalytic cracking unit of latest design, a vacuum flasher, gas recovery plant, polymerization and treating units. New office buildings and shops will be constructed and tank storage for refined products will be increased by 300,000 barrels.

The present expansion program marks the third time in recent years that such an undertaking has been necessary. In 1946 the company carried out an enlargement and again two years later further expansion was required. This rapid expansion is indicative of the fast population increase and economic growth in British Columbia. The expanded refinery will provide the province with aviation fuel, motor gasoline, diesel and heating oils, bunker fuel, asphalt and other products.

At the present time most of the crude oil refined at Shellburn is imported by tanker from California. However, since the completion of the expansion program coincides with the completion of the Trans Mountain Oil Pipe Line in late 1953, California oil will be replaced by Canadian crude. Shell Oil Company of Canada has a substantial interest in the $82 million Trans Mountain Pipe Line.

Most recent announcement of new refinery construction in British Columbia is the proposed 5,000-barrel plant to be built in the Brockelhurst area west of Kamloops by Refinery Operations Ltd. of Calgary. Options have been taken on a site on the Trans Mountain pipe line.

Largest refinery completed in Canada in 1952 was the entirely new plant of Canadian Oil Refineries Ltd. in the Sarnia district.

Most northern refinery in Canada is the Norman Wells, N.W.T., plant of Imperial Oil Ltd.

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Construction work on the $6 million project is slated to get under way in July. Completion before the end of 1954 is estimated.

Refinery Operators Ltd. recently completed a 5,000-barrel skimming plant at Coleville, Sask.

The trend in refinery construction in Canada has been largely toward the production of maximum volumes of gasoline and middle distillates and minimum quantities of residual fuel. Most of the recent plants of any size are equipped with coking units and catalytic crackers. Canadian plants are currently obtaining a yield of 18.7 percent heavy fuel compared with 19.6 percent in 1950 and 20.6 in 1949.

In the rush to obtain volume of output, Canada has not been expanding its lubricating oil producing facilities as rapidly as those for gasoline and middle distillates. A notable exception is the recently announced building program of Imperial Oil Limited at Edmonton.

Grease manufacturing facilities are being expanded this year by British American Oil Co. Canadian Oil Companies opened a new $2 million plant in 1953. The new $1.5 million British American plant described elsewhere in this issue will produce 15 million pounds per year.

Before the erection of these new plants, Canada was importing about a third of its grease requirements. Domestic production in 1951 was 63 million pounds and imports 13 million pounds to supply a domestic demand of 76 million pounds.

British American Oil Co. Ltd. recently announced that it will spend $8 million in rounding out the Clarkson plant through the construction of an 11,000-barrel catalytic cracking unit and a 600-barrel polymerization unit. This work is expected to be completed in 1954.

Clarkson is on the shore of Lake Ontario in the highly industrialized area between Hamilton and Toronto. It is beyond the proposed Interprovincial pipe line extension which will end at Sarnia. British American thus will continue to rely on lake tankers to supply crude.

The plant has docking facilities for handling four tankers simultaneously. British American has completed two very large crude carriers in the past two years and will continue these in service. Most recent addition to the British American fleet was the $4.5 million "Peerless" with a cargo capacity of 130,000 barrels.

Completion of Sun Oil Company's 15,000 barrel refinery at Sarnia is scheduled for September of this year. Foundations were started last October and structural steel erection begun in February. The plant will be Sun's first in Canada. Previously the company has supplied its Canadian customers from its Toledo, Ohio, refinery.

The Sun plant will include a Houdriflow catalytic cracking unit under license from Houdry Process Corp. The unit will be of the integral reactor-kiln type with a capacity of 11,500 b/d. Clay catalyst will be used with circulation at the rate of 300 tons per hour. Plans also call for the erection of a 3,000 b/d Houdriforming plant for the upgrading of gasoline.

Construction work is being done by Catalytic Construction Co. Catalytic has handled engineering work aside from the Houdry cracking unit and is doing all construction under a master contract.

Crude for Sun's new plant will be received by pipe line from United States fields for the present at least. Products will be shipped by a new pipe line being laid from Sarnia to Toronto and intermediate points.

Trinidad Leaseholds (Canada) Ltd. has purchased 80 acres adjacent to the site of its present 7,000-barrel refinery at Port Credit, Ont., as a preliminary to an expansion program. Present work in progress includes modernization of utilities, including erection of an improved steam plant and a better cooling water circulating system.

During the next two years Trinidad expects to install a new topping unit with vacuum facilities for recovery of cracking feed stock. Major new unit construction will include a fluid catalytic cracking unit and possibly a Platforming unit. Capacity of the plant will be increased to 12,000 b/d. The new facilities are expected to be ready for operation in April, 1955.

A newcomer in Ontario this year is Riverlakes Oils Ltd., which purchased a refinery in Texas and moved it to Fort William. The plant began operations in February. A cycloversion unit is under construction. Capacity of the plant is 2,500 b/d.

A new round of construction in Quebec now seems to be in the making as demand in that province continues to climb steadily higher.

A 25 percent increase in the capacity of Imperial Oil's Montreal East refinery was announced early in March by general superintendent Charles Scrymgeour. About $10 million will be spent on construction work which is expected to be finished early in 1954.

The new construction will increase capacity by 12,000 barrels to 58,000 barrels a day. The refinery will continue to be Canada's second largest, surpassed only by the Imperial plant at Sarnia.

Canada's first catalytic cracking unit, which was installed at Montreal East in 1948, will be enlarged. New equipment to be installed includes an atmospheric and vacuum distillation unit and a vacuum pipe still.

Imperial's original refinery at Montreal East was built in 1916 with a capacity of 4,000 barrels a day. Crude oil for the refinery originates chiefly in Venezuela and comes by pipe line from Portland, Maine. During the open navigation season some crude also comes by tanker direct.

McColl-Frontenac Oil Co. Ltd. recently installed a new crude fractionating tower at its 43,000-barrel Montreal East refinery. The tower is 12 feet in diameter and 130 feet high with a design throughput of 24,000 b/d. Installation of the tower permitted the company to retire a portion of its crude stilling facilities. It has been rumored that this company is considering additional construction work at this plant in the near future, but company officials will not confirm the report. The plant has been very greatly expanded in recent years.

Much of the construction work at Montreal East this past year has been in the petrochemical field. Shell has erected an alcohol plant and British American and Shawinigan Chemical Co. a phenol plant. Dominion Tar and Chemical Co. has built a glycol plant to process still gases from adjacent refineries. Details regarding these petrochemical plants are given elsewhere in this issue.

Despite the very active building in the Prairie Provinces since Leduc, there seems still to be much work to be done in the immediate future. One new project announced in recent weeks is the $10 million lube plant to be built by Imperial at Edmonton. H. H. Moor, superintendent, revealed that the plant will produce 2,000 b/d of lubes when completed in 1955. Engineering work has been done and actual construction will be undertaken in 1954.

The new plant will include a solvent extraction unit, a solvent de-waxing unit, and equipment for finishing and packaging lubricating oils. The refinery's laboratory facilities will be expanded to look after the new equipment which will employ more than 100 men and turn out some 110 different products, all of which are now imported into the area.

Construction of the lubricating oil plant will be one more step in the almost continuous program of expansion and modernization at the Edmonton refinery since it was built in 1948. When it was erected, using units from a wartime surplus refinery at Whitehorse, Y.T., the refinery had a capacity of 6,000 b/d. As crude oil production in the Edmonton area rose, the plant was steadily enlarged and modernized to care for local requirements and capacity now stands at 22,600 b/d. A gas recovery unit and a fluid catalytic cracking unit were recently completed.

The new Edmonton cracking unit known as a Model IV is the first of its kind to be built. It was designed by the Standard Oil Development Co. and installed by Foster-Wheeler Ltd., contractors for the $5 million modernization program at the refinery. New vacuum distillation and gas recovery units are also in operation.

The new Model IV cracking unit embodies an entirely new system of catalyst transfer. With no throttling slide valves, which controlled the rate of catalyst transfer between vessels on previous fluid units, lower overall height, simplified vessel de-

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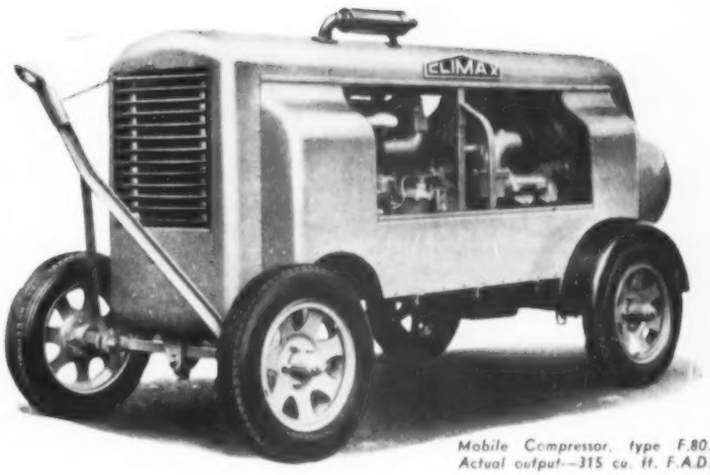

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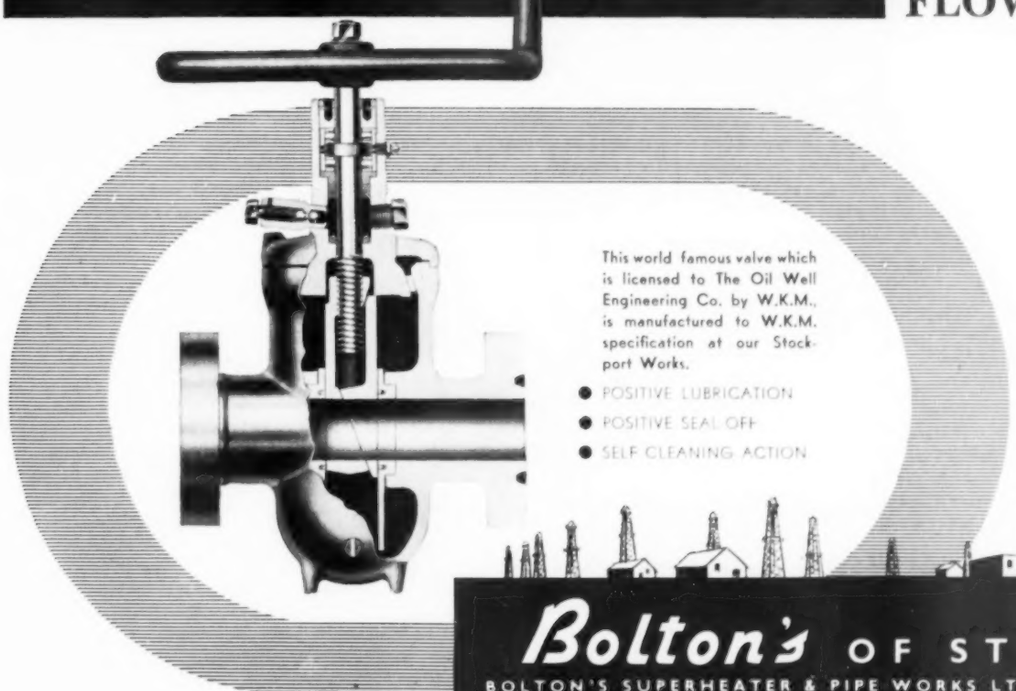

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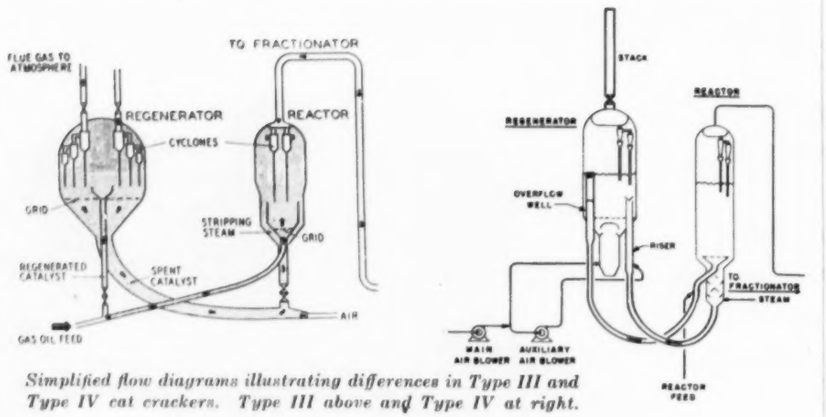

Simplified flow diagrams illustrating differences in Type III and Type IV cat crackers. Type III above and Type IV at right.

sign and simpler reactor and regenerator internals, Imperial realizes considerable savings both in initial investment and in operating and maintenance charges.

In the new catalyst transfer system, the feed stock enters the catalyst transfer line carrying regenerated catalyst from the regenerator to the reactor at a point just below the reactor. The hot regenerated catalyst causes the feed stock to vaporize instantly, and the oil vapor-catalyst mixture enters the reactor. Spent catalyst leaves the reactor through the second catalyst transfer line. The density of the catalyst flowing up the riser to the regenerator is lowered by introduction of air and thus the catalyst is forced into the vessel under its own pressure head. The rate of air flow to this spent catalyst transfer line established the catalyst-to-oil ratio in the system without the use of throttling slide valves. After regeneration the catalyst enters the regenerated catalyst transfer line to complete the fluid cycle.

Accompanying charts indicate flow through the Model IV unit and the earlier Model III.

With a capacity of 10,000 barrels per day, the new Edmonton fluid cat cracker is one of a total of 20 similar units now in various stages of construction throughout the world. When completed, they will have a combined total throughput of some 295,000 barrels per day.

Commenting on the new Alberta unit, Standard Oil Development Co. engineers stated that the Model IV design had gained wide acceptance among refiners even before the first unit had been placed in commercial operation. The new unit at Edmonton had exceeded expectations in all respects.

Elimination of throttling slide valves to control the flow of catalyst between vessels has made the unit both easier to operate and more stable in operation. With all controls grouped at a single level near the ground, the Model IV requires less operating personnel than was needed for Model III units.

Company engineers stated that "reverse flow" was far less likely with the new units than with any previous fluid cat crackers. A serious pressure differential between reactor and regenerator will cause the fluidized catalyst to "de-fluidize" in this system to form an effective temporary seal. As soon as the pressures in the vessels are in balance again, the catalyst "refluidizes" of its own accord, restoring normal circulation. This novel principle is held to make the unit safer, more stable and easier to operate than any previous fluid catalytic cracking unit.

Imperial also is spending $7 million to modernize its Regina, Sask., refinery. Major contract for construction is in the hands of the Fluor Corporation.

The contract includes the building of a 7,500-barrel fluid catalytic cracking unit, a vacuum distillation unit with a 9,000-barrel capacity and a light ends plant for the recovery of gases.

The expansion program, to be carried out on the refinery's present 255-acre site, will raise capacity from 20,000 to 22,000 b/d. Work will begin shortly on a 250-barrel catalytic polymerization plant. About three-quarters of a million dollars will be spent on the new equipment.

A second important refinery project at Regina is the $7.5 million expansion and modernization of the Consumers' Cooperative Refineries Ltd. plant under a prime contract with Refinery Engineering Co. Completion is scheduled for July 1, 1954 at which time capacity will rise from 6,500 b/d to 12,000 b/d. Processing units to be installed include: a 6,500 b/sd vacuum unit, 5,000 b/sd 75 percent conversion catalytic cracking unit, high pressure gasoline plant, catalytic polymerization plant, LPGas facilities, 5,000 b/sd treater for straight run gasoline, and a 4,000 b/sd treater for cracked gasoline.

Offsite facilities to be built include complete new marketing facilities, storage, sewage and water, and laboratory buildings.

Outstanding 1952 addition to Prairie capacity was the completion by British-American of a 10,000-barrel refinery at Moose Jaw, Sask.* It is of special interest because of its emphasis on production of high octane gasoline and diesel fuel and minimizing of kerosine and residual fuel. The plant is an example of integration of topping and cracking functions for simplification of operation. It features continuous flow of hot and intermediate stocks from one operation to the next with complete integration of controls and auxiliary facilities. Catalytic cracking, coking, thermal cracking, gas concentration and polymerization are grouped around a central pump and control house.

At Regina, Hi-Way Refineries Ltd. increased its crude capacity 2,000 b/sd to 5,000 b/sd and its thermal cracking capacity from 800 to 1,500 b/sd. The company's subsidiary, Saskatoon Pipe Line Co., built a 6-inch crude line from Milden to Saskatoon to make connection with the Interprovincial pipe line. Hi-Way will continue to manufacture asphalt and road oils from heavy Saskatchewan crude and will run additional quantities of Alberta crude.

The 1953 Hi-Way program includes construction to increase the crude capacity to 6,500 b/d; the installation of a UOP fluid catalytic cracking unit with a capacity of 2,600 b/d as well as vis-breaking capacity of 3,500 b/d; and desulfurization of gasoline having a capacity of 1,600 b/d. The 1953 program is estimated to cost $2,500,000. Refinery Engineering Ltd. of Toronto has the contract for this work, and it is expected that the new units will go on stream in December of 1953.

Moose Jaw Refineries Ltd. was relocated at Moose Jaw, Sask., in 1952. As part of the rebuilding operations, storage capacity was enlarged. The plant has a topping capacity of 2,000 b/d and a catalytic reforming and desulfurization capacity of 300 b/d.

Wainwright Refineries Ltd. has purchased the former Gold Standard Oils Ltd. plant at Wainwright, Alberta. Petroleum Rectifying Co. of California is installing a dehydrating and desalting unit which will go into operation in May.

Husky Oil and Refining Ltd., Calgary, has recently completed an asphalt specialties plant which went on stream March 1 and a new asphalt blow still which was completed May 1. A new gasoline reformer will be ready to operate by June 1. Tankage has been augmented.

Despite the rapid rate at which building has been carried on in recent years, the domestic refining industry is still about 100,000 b/d below the desired level to meet Canadian demand. Consumption in Canada has been growing at a pace too swift for the builders.

Radio Oil Refineries, Ltd., Winnipeg, is considering the erection of a catalytic cracking unit, but plans have not yet been finalized. The plant's current capacity is 2,000 b/d.

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*The plant was described in detail in WORLD PETROLEUM, Feb. 1953, p. 38.

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British American completes Clarkson grease plant

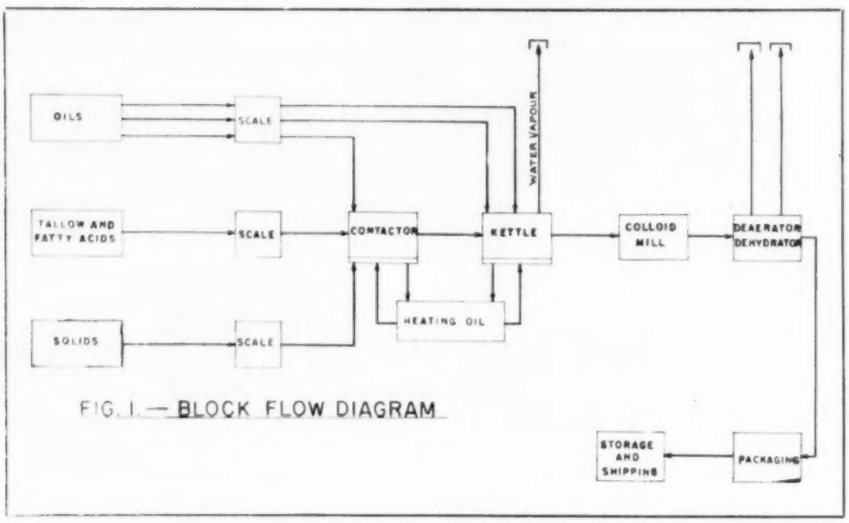


FIG. 1.—BLOCK FLOW DIAGRAM

F. Lloyd Johnson is a senior process engineer with the British American Oil Company at Toronto. He received his B.A. Sc. in Chemical Engineering from the University of Toronto in 1939 and was employed by the Bahrain Petroleum Company at its refinery on Bahrain Island, Persian Gulf. Since joining B-A in 1941, he has held a variety of positions in the fields of laboratory, operating, planning and engineering with the company at its refineries at Toronto and Clarkson, Ontario, as well as at the head office in Toronto.

By F. Lloyd Johnson

CONSTRUCTION of British American Oil's grease manufacturing plant at the company's Clarkson, Ont., refinery was completed and the facilities placed in production on April 1 of this year. The plant, which represents a $1,500,000 investment, has been designed for the production of up to 15 million pounds per year when operating on an 8-hour day, 250-day per year basis. It will materially reduce imports of finished greases into Canada.

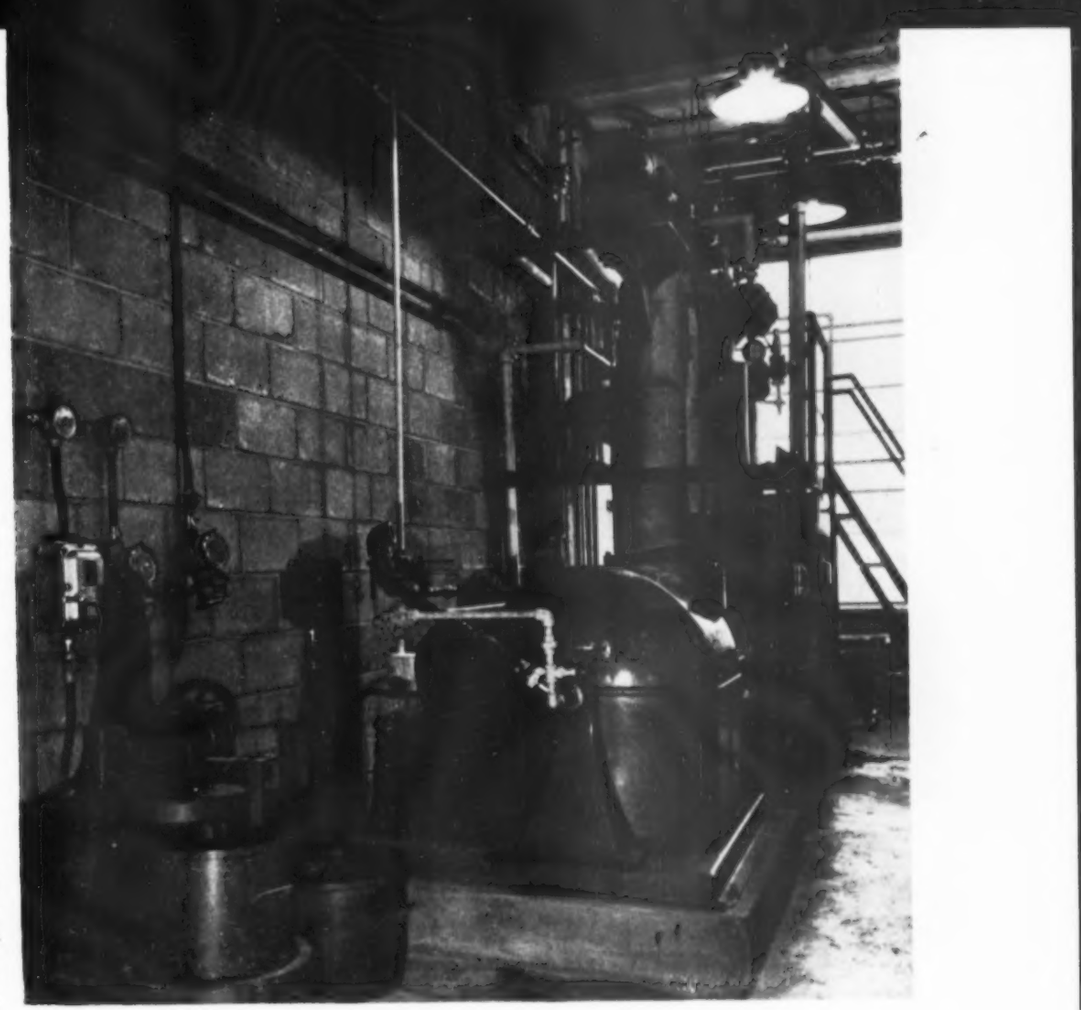
The C. W. Nofsinger Co. of Kansas City, Mo. handled the engineering design, N. A. Armstrong of Toronto designed the building, British American carried out purchasing and expediting as well as the off-site work, while Pigott Construction Co. of Toronto was the general contractor. These forces have combined to provide the company with a plant which is capable of producing a full range of greases of a consistently high quality and uniformity. Production from the plant will supplant the products formerly purchased by the company to supply its market for solid lubricants. Raw materials to be processed in the new plant will be almost entirely of Canadian origin. The petroleum oils being used are naphthenic lube oils from the company's Montreal East refinery and paraffinic lube oils from the Clarkson refinery.

The building, of concrete block construction, covers an area approximately 100 x 240 feet. That part of the building which houses the storage tanks, contactor, kettles, pilot plant, laboratory and other process and utilities equipment, is three stories high, while the section occupied by the filling lines, warehouse and shipping departments is of single story construction. The plant is located alongside a railway spur line and a covered loading platform extends the entire length of the building to facilitate the handling of incoming and outgoing materials. Provision is also made for shipping by truck transport.

The principal types of lubricants which the facilities were designed to manufacture include calcium, sodium, lithium, barium, mixed-base and non-soap greases. Raw materials required include a full range of fats and fatty acids, both saturated and unsaturated, basic ingredients involved in the saponification processes, and a wide range of viscosities and types of mineral oils.

The manner in which raw materials pass through the plant and emerge as packaged products is indicated by the block flow diagram, Fig. 1.

Both indoor and outdoor storage facilities are provided. Oil and tallow may be unloaded from tank cars by a pump provided for this purpose at the unloading rack. The oils may also be brought from

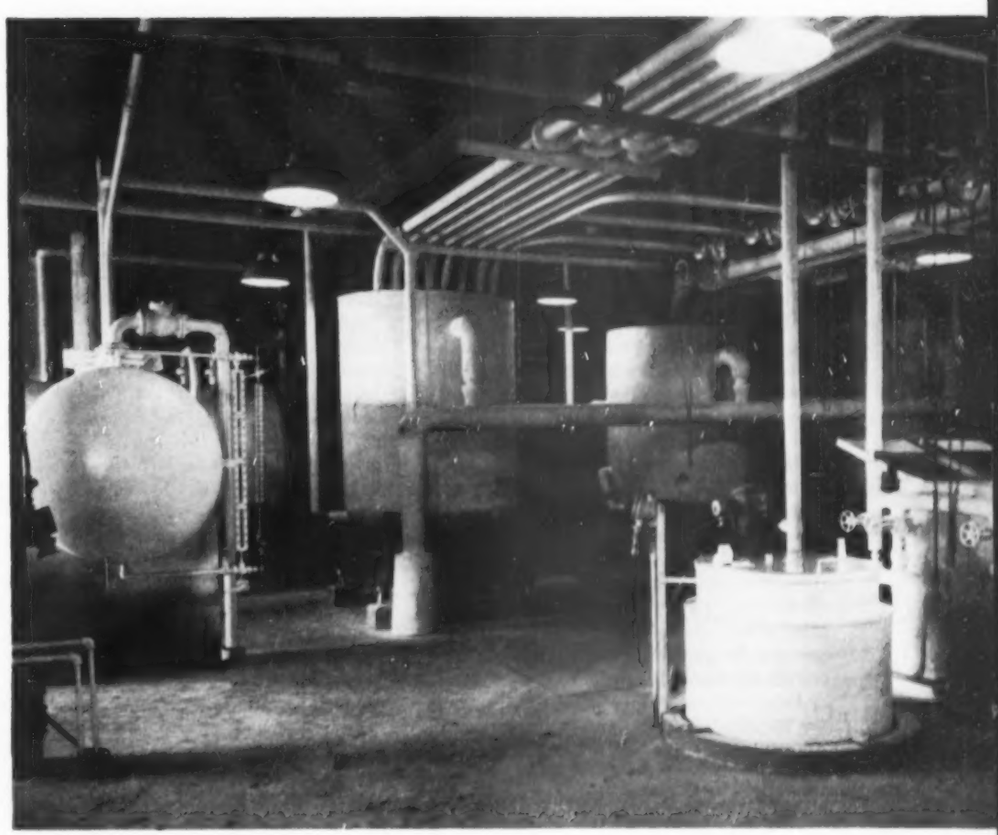


A pilot plant of sufficient size to produce commercial batches of finished lubricants has been installed in the grease plant laboratory. The pilot plant is used to develop formulations of new greases for road testing on a fleet scale.

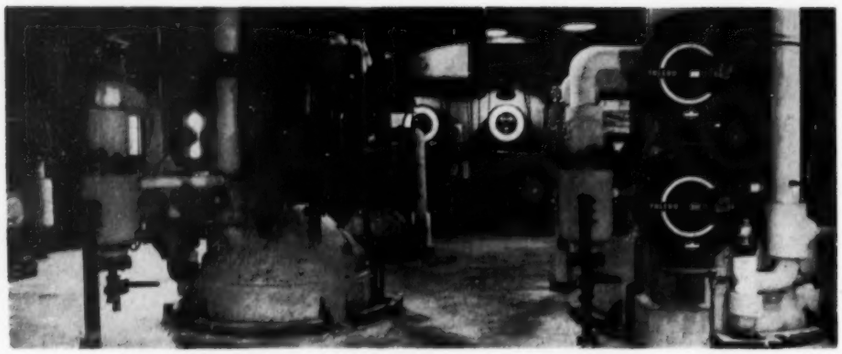
the refinery lube oil storage tanks. Five outside storage tanks are provided for miscellaneous lube oil stocks. Each of these has a built-in suction steam heater and is serviced by its individual reversible pump.

Indoors, oils are stored in six tanks and are maintained at above room temperatures by means of individual suction-type steam heaters built into the tanks. The fatty acid and tallow storage tanks are insulated and have side entering mixers. These materials are maintained at 120° and 150°F by means of steam coils on the outside of the conical bottoms of the tanks. Temperature controls and indicators are provided for each inside tank and heater. Each tank is serviced by an individual pump for pumping out and for recirculation through the heaters.

The flow of process materials from storage to weigh tanks is controlled from the instrument board by means of hand control valves. In addition to the scale dials at the equipment, remote dials are provided within viewing distance of the control panel so that weighing can be done



Weigh tanks on the third floor from which oils and fats are delivered to kettles and contactor on the floor below. Cold oil surge drum is in the left foreground with relief tank behind it. A small open grease kettle and barrel heating box are in the right foreground.



Kettle area showing 8,000-pound pressure kettle, 6,000-pound contactor, and 12,000-pound atmospheric kettle. A 15,000-pound pressure kettle is yet to be installed.

by the operator at the panel. The piping at the weigh tanks is arranged so that the process materials can be returned to storage if necessary. Each tank is provided with a high level signal and alarm and overflow to a tank designed for this service. The tallow weigh tanks are wrapped with outside steam coils while the two weigh tanks for oil have coils on the outside of the cone bottom only.

Several sizes and types of reaction kettles are provided for the sake of flexibility with respect to both quantity and type of grease to be manufactured. The 15,000-pound and 8,000-pound kettles may operate under vacuum or at pressures up to 150 psig, whereas the 12,000-pound kettle is for operation at atmospheric pressure only. All kettles have jackets through which heating oil and, on occasion, cooling oil may be pumped. Two smaller kettles, one of which is jacketed, are for the manufacture of cold set greases. Still another kettle is used for melting tallow and other compounds and can also serve as a rundown tank. The 6,000-pound contactor is common to all these kettles. It is used primarily for saponification, but may also be used for the dispersion of soap into the oil. All kettles and the contactor are equipped with mixers.

Finished grease is pumped from the kettle through the colloid mill. The pump is specially designed to maintain the pressures required in the handling of the different grades of grease. The mill improves homogeneity of product and enhances its mechanical and storage characteristics. From the mill, the grease passes to the deaerator. This equipment, again of special design for this plant, operates under vacuum to remove entrained air and any undesired moisture. Removal of the air increases oxidation resistance and allows the product to assume the normal color of the oils used. From the deaerator, product is pumped to one of the three conveyor line filling stations.

Automatic container filling equipment for 25-pound drums is provided at present. Additional equipment for containers of other sizes may be added later when volume production is established.

Full use is made of conveyor systems. Conveyors carry empty containers from freight cars to storage area. Another conveyor brings empty containers to the packaging area where they are filled, weighed and stencilled. Filled containers are loaded onto pallets which are taken by a gasoline-driven fork truck to the storage area which can store 500,000 pounds of grease in containers which hold 5, 10, 25, 100 or 400 pounds.

The actual grease making operation may be followed in the accompanying flow diagram. (See Fig. 1).

The contactor is charged with the required amount of fat or fatty acid and heated to 200°F in about ten minutes, after which the alkaline dry solids which have been weighed during the heating process are also charged to the contactor and the vapor outlet valve closed. The temperature is then raised rapidly to 350°-400°F. The pressure is then about 70 psig. When this temperature is reached, the soap is flushed into the finishing kettle, which has already been partially filled with oil and heated to about 200°F; the quantity of this oil is generally sufficient to bring the kettle content to 40 percent of the final volume. The batch is in some cases then heated again to 350°-400°F. During this operation a large part of the water will be vented off. When closed kettles are used, the pressure is reduced gradually and eventually a vacuum may be applied by means of a steam jet ejector to attain the desired water content.

At the end of this operation, the remaining oil is charged to the kettle at a temperature sufficient to reduce the overall batch temperature to the proper packaging or milling temperature which ranges from 150° to 250°F. In some cases, it is necessary to circulate cooling oil through the kettle jacket. Facilities are provided for this purpose. The grease is circulated for 10 minutes longer to produce a uniform product. Then it is pumped from the kettle through the Charlotte Mill where it is homogenized, then through the deaerator where air and moisture are removed to the desired extent before packaging.

The cycle for sodium grease, as described above, usually takes slightly less than two hours and is sufficient for the 15,000-pound kettle operation when the grease is packaged in large containers. Of this time, the contactor is used slightly less than one hour for the batch. To make the desired production rate of 60,000 pounds per day, it is necessary to make less than two full batches per day in each of the three main kettles. The contactor will be in operation as required to produce the soap and disperse soap and oil when desired. For the production of certain special greases, the contactor may occasionally not be used.

Heating of the kettles and contactor is by means of hot oil at 450-500°F pumped through each vessel jacket at rates of 200 to 300 gpm. The oil is heated in a gas fired furnace which has a small radiant section, a tubular convection section, and an air preheater. The hot oil circulating pump sends the jacket oil through the furnace and into a surge drum. From there the jacket oil pump sends the oil to the heating jackets from which it returns to the surge drum.

The control panels, conveniently located on the second floor adjacent to the contactor, kettles and inside storage tanks, are equipped with nine recording temperature controllers. These instruments allow the operator to control remotely the temperatures of liquid fats and oils when being charged to any one of the kettles or the contactor. An additional RTC gives him control of the temperature of the circulating heating oil. Temperatures throughout various sections of the process may be checked by means of a conventional multipoint potentiometer, while the kettle and contactor temperatures can be observed on a four-point recorder. Instrumentation of this type, where temperature records are available for each batch of grease, results in economy of operation as well as uniformity of product.

The grease plant is almost completely self-sufficient with respect to laboratory services. The laboratory within the grease plant building is fully equipped and staffed for control testing and development work. Testing equipment is provided for performing all important tests common to the great industry.

Adjoining the laboratory is the pilot plant room. The pilot plant is, in reality, a small scale production unit with a capacity of 400 pounds, and is capable of duplicating, on a reduced scale, all operations of the full scale plant. Equipment includes, in addition to the contactor and kettle, a miniature colloid mill and vacuum dehydrator-deaerator. It is possible, therefore, to develop formulations and most efficient process conditions by making use of the pilot plant. Prior to the completion of the grease plant building, the pilot plant was set up in a temporary building and operated for several months to develop the formulations which are now being used in the grease plant proper.

Banff Oil Ltd.

announces the election of

- **WALTON H. HOHAG, Jr.**

as Vice President, Director and General Manager effective March 17, 1953

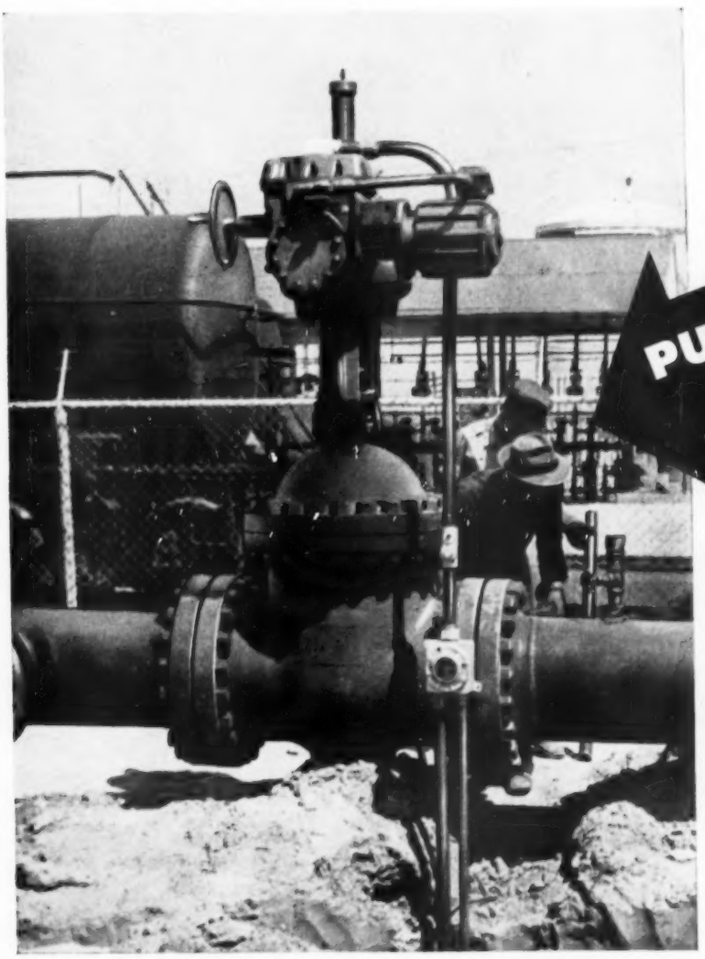
- Mr. Hohag, Jr. until recently was a Director, Vice President and Manager of Exploration of Socony-Vacuum Exploration Company

Banff Oil Ltd.
Head Office: 809 Eighth Ave. West,
Calgary, Alberta, Canada

Banff Oil Ltd., an exploration and development oil company operating in western Canada, announces that Walton H. Hohag Jr. has been elected a Director, Vice-President and General Manager of its operations.

Mr. Hohag was formerly a Director and Vice-President of Socony Vacuum Exploration Company and also Manager of Exploration of that Company for the past few years during which time Socony made important discoveries. He comes to Banff with a wealth of oil exploration experience in Canada in addition to his previous exploration experience in Saudi Arabia, California, and the Rocky Mountain area.

Banff Oil is now participating in a drilling program in the Bonnie Glen and Armena areas in Alberta and plans call for substantially increased exploration and development activities during the approaching season. Attractive acreage in which the Company holds interests includes properties in the Camrose, Erskine and St. Albert areas, all bordering recent discoveries or production. Total gross land holdings of the Company aggregate about 2,356,500 acres consisting of approximately 77,000 net acres of oil and gas leases and approximately 427,000 net acres of reservations. The Company has varying interests in forty-one producing wells. Cash and short term United States and Canadian Government obligations total approximately $2,000,000. In September 1952 a group of investment firms headed by Lehman Brothers, New York, did the public financing in Canada and the United States. Link & Nauss Ltd., Calgary, are consultants for the Company.



Typically, this motor-operated, 18-inch Darling cast steel gate valve, of the fully revolving, double disc parallel seat type, is now cutting costs and maintenance on a major cross-country products line.

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Ethylene glycol plant built by Dominion Tar and Chemical Company at Montreal East is supplied with raw material from nearby oil refineries.

Canada builds petrochemical industry

BEFORE THE CLOSE of 1953, Canada will have a petrochemical industry with an investment in plants totaling $200 million. This is an increase of $155 million since World War II, when the $45 million government synthetic rubber plant was built at Sarnia, Ont.

Much of the new investment has been made in the west as a result of the discovery there of great new natural gas reserves. The Prairies are producing fertilizer and sulfur now from gas, and before many months, a long list of chemical intermediates will begin to reach world markets.

In the Montreal refinery center, three new petrochemical plants are going on stream this year. Each of these is based on refinery still gases. The Sarnia district is the scene of a major expansion in the production of rubber and other plastics and intermediates.

Operations recently were begun at the $10 million Montreal East plant of Dominion Tar and Chemical Co. which was erected to manufacture ethylene glycol from cracking still gases piped from nearby McColl-Frontenac and Shell Oil Co. refineries. Ethylene is stripped from the still gases and the remainder returned to the refiners. Chlorine for the process is available at a nearby Dominion Tar and Chemical plant at Beauharnois, Que. The $5 million plant was built by Stone and Webster Engineering Co.

The process employed in the separation of ethylene from refinery still gases is said to be unique. The raw gas is stripped of hydrogen sulfide and carbon dioxide by usual methods and then compressed and split into three main fractions. The ethylene separation unit performs this function by means of a system of expansion and heat exchange. No external refrigeration is required. At one stage power is generated by expanding a gas fraction through an expansion engine driving a generator. The energy removed helps lower the stream temperature, which goes as low as —260° F.

The refinery gases are fractionated at moderate pressure and at low temperatures to concentrate the desired ethylene-ethane fraction. The mixed C_2's are fed to the chlorohydrin reactors while both heavier and lighter hydrocarbons are returned to Shell and McColl-Frontenac. The chlorohydrin reactor rejects the ethane, which is passed to a high temperature cracking still for the production of additional ethylene. The two steps utilize virtually all of the C_2 from the refinery gas stream. Hydrogen produced in the cracking still is mingled with the tail gases and pumped to the refineries.

Dominion Tar has adopted special methods to control processing conditions, especially temperature, in the reactor to produce maximum quantities of ethylene chlorohydrin and minimum quantities of ethylene dichloride. The ethylene chlorohydrin is subsequently reduced to ethylene oxide by the addition of lime and steam.

Ethylene oxide which is not required for sale as such is hydrated with the aid of sulfuric acid as a catalyst to produce ethylene glycol and higher glycols. Two main plant products are ethylene oxide and ethylene glycol. Products of lesser importance include propylene oxide and glycol, diethylene and other polyglycols, ethylene dichloride, tetrachlorethane and dichlorodiethyl ether. The latter is employed as a solvent for fats, waxes and resins.

The new Dominion Tar plant is of particular value to the Canadian economy for the production of antifreeze to reduce imports. About 80 percent of the output will be glycol.

Only other similar plant in Canada is that of Dow Chemical Company at Sarnia which has been processing still gases from the Imperial Oil Ltd. refinery for the past three years. Dow has been enlarging its plant during the past year at a cost of $17 million so that it will be able to process still gases from the new Canadian Oil Companies refinery at Froomfield. Imperial also now has more refinery vapor as a result of its recent expansion. Sun Oil Company will add to the available supply with its new Sarnia plant late this year.

Dow manufactures styrene for the adjacent government rubber plant and for plastics as well as ethylene oxide, ethylene glycol and other chemicals.

Polymer Corp., the government rubber plant, also was able to increase its capacity currently as a result of the new refinery construction. A 25 percent increase costing $10 million has brought investment in the plant to $66 million. Plant production prior to the expansion totaled 34.3 million pounds of butyl rubber and 114.4 million pounds of buna rubber per year.

First phenol plant in Canada and the first completed commercial plant in the world to employ the new Hercules cumene process recently was completed at Montreal East by British American Oil Co. and Shawinigan Chemical Co. In the United States a similar plant is being built by Standard Oil Co. of California.

(Please turn to page 157)

CHEMICAL PROCESS NEWS

PUBLISHED BY CHEMICAL PROCESS DIVISION, THE M. W. KELLOGG COMPANY MAY 1953

NOTES ON

Ammonia

Of vital importance to the efficiency and low maintenance cost of any ammonia plant is the design of the reactor in which synthesis gas is converted to the end product.

* * *

Close control of temperature is extremely important in the reactor. To attain a reaction rate high enough to produce an economic yield of ammonia, temperatures must closely approach a critical point. Should this point be exceeded, catalyst activity deteriorates rapidly and construction materials are subject to accelerated attack by corrosion.

* * *

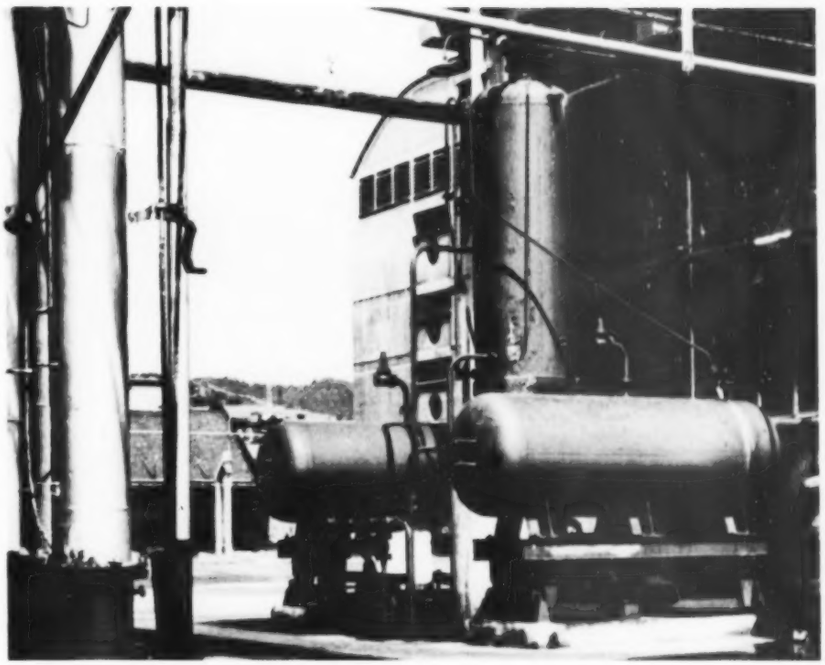
In the ideal ammonia converter, it is essential to remove excess heat as rapidly as possible from every point where exothermic reaction occurs. Since these points "move about" through changes in the conditions of operation and through aging of catalyst, the design of an economical converter that completely solves the problem of excess heat removal is a difficult engineering feat.

* * *

The Kellogg reactor, which employs layers of catalyst with an efficient means of cooling the gases in between, closely approaches the ideal point-by-point temperature control.

* * *

In addition to a 150 ton-per-day plant now going up on the West Coast, Kellogg has designed several others employing this type of reactor. Three large ones were built virtually simultaneously during World War II. Since they have been in operation they have continued to maintain the highest efficiency levels in the industry.



Lower Initial Investment, Decreased Operating Cost with New Urea Process

A new, low-cost method of producing synthetic urea of exceptional purity from ammonia and carbon dioxide is now available in the United States through Kellogg. Known as the Montecatini Urea Process—after the well-known Italian firm which developed it—the method reflects more than 30 years of experience in nitrogen chemistry.

One of the important features of the Montecatini process is the reduction in operating cost due to the virtual elimination of the corrosion problems generally associated with urea synthesis. This is accomplished not only through judicious materials selection but also through the use of relatively mild operating conditions in the reaction zone in comparison with other urea processes. Furthermore, high concentration of ammonia also tends to curb corrosion.

To reduce initial investment, as well as operating costs, the process employs a partial recycle of ammonia and ammonium carbamate in liquid form in order to keep to a minimum the need for costly compressors. The lower temperatures employed eliminate the necessity for employing expensive alloy equipment in many parts of the plant.

While a total recycle plant that gives 100% yields has been piloted, the present commercially operating process makes it possible to obtain 70 and 80 wt. % conversion of NH_3 and CO_2 respectively. Considering the fact that urea production is often in connection with the preparation of fertilizer products, the existence of excess ammonia in the tail gas provides a ready source of NH_3 for additional production of the standard sulfate and nitrate fertilizers.

In addition to these factors affecting the costs of plant and operation, it is also of interest that the process produces resin-grade urea under all conditions without the additional expense of a special purification step to remove entrained impurities. The product from the Montecatini process meets the following specifications:

Nitrogen	46.3 wt. %
Water Content	0.5 wt. %
Free NH_3	0.02 wt. %
Ash	0.003 wt. %
Biuret	0.01 wt. %
Aqueous solution of 5% urea	clear and colorless

This final specification is a difficult one to meet and is particularly important for plastics manufacture. The low biuret content is also of importance in this application.

This process employs no lead-lined equipment, eliminating any possibility of lead toxicity when urea is used as cattle feed supplement.

(SEE REVERSE SIDE)

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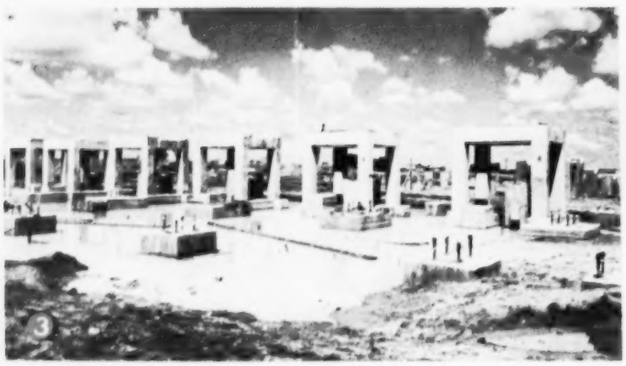

More than 20 Major Chemical Processing Steps Involved in Project

The South African project to obtain gasoline, diesel fuel and chemicals from indigenous coal deposits is now well underway. The huge $50 million plant, for which Kellogg is project manager, comprises a multitude of different units. The overall program includes projects from the opening of a virgin coal mine to the final production of fuels and purification of chemicals. Progress photos shown here include just four of the major chemical processing projects included in this most complex chemical engineering-contracting task for South African Coal, Oil and Gas Corporation (SASOL).

Photo No. 1 shows the unit which will receive the gas stream from the coal gasification plant to produce synthesis gas. This is then fed to Kellogg's unique Synthol process (Photo No. 2) where the actual synthesizing step is performed. Progress on the fixed bed catalytic operation is shown in Photo No. 3. When completed, the foundations shown in Photo No. 4 will support the oil recovery system.

Among the chemicals which will be produced as dictated by market conditions are ethanol, propanol, butanol, acetone, methyl ethyl ketone, benzol, toluol, phenol, ammonium sulfate, light and heavy creosotes and several waxes and tars.

* * *

For further information, technical data, etc., relating to chemical or petrochemical processing, write

RESA Branch Is Installed at Kellogg

Dr. Donald B. Prentice, National Director of the Scientific Research Society of America (RESA), presents official charter to Joseph F. Skelly, first president of the new Kellogg RESA branch. Warren L. Smith, president of Kellogg standing at left, was one of prime movers for formation of a RESA unit. The Company mustered 58 charter members at the recent investment ceremony, expects the branch's eventual membership to number in the hundreds.

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THE M. W. KELLOGG COMPANY
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California Standard Co., The
Canadian Gulf Oil Company
Delhi Oil Corporation
Donnally Exploration Company
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Donnally Seismograph Company
Electronic Logging and Velocity Co., Ltd.
Empire Geophysical, Inc.
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Geophysical Prospecting Co., Ltd.
Gulf Oil Corporation
Heard Exploration Company
Hooks Exploration Company
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Independent Exploration Co.
Inter-American Geophysical Co., Ltd.
Japanese Government
Kerr-McGee Oil Industries, Inc.
Louisiana Oil Exploration Co.
Mayes-Bevan Company
McCollum Exploration Company
Midwest Exploration Company
Montex Exploration Company
Nance Exploration Company
Neuman, L. J. Company
New Mexico Institute of Mining and Tech.
Northwest Seismic Surveys, Ltd.
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Petroleum Geophysical Company
Plymouth Oil Company
Portable Seismograph, Inc.
Precision Exploration Company
Purcell Exploration Service
Robert H. Ray Company
Rayflex Exploration Company
Research Explorations, Inc.
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Seismograph Service Corporation
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Seismotech, Ltd.
Sinclair Oil & Gas Company
Sinclair Research Laboratories, Inc.
Sohio Petroleum Company
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Texas Seismograph Company
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These companies all have one thing in common: they all have **at least one complete set of portable or truck mounted** SIE Seismograph Instruments. If you know geophysicists with these companies, we would like for you to ask them for their personal opinion of SIE instruments . . . because these men have watched SIE Instruments get the records under good and bad conditions in practically every part of the world. That's why these **70 companies** have purchased **161 sets** of SIE Seismograph Instruments in the past five years.

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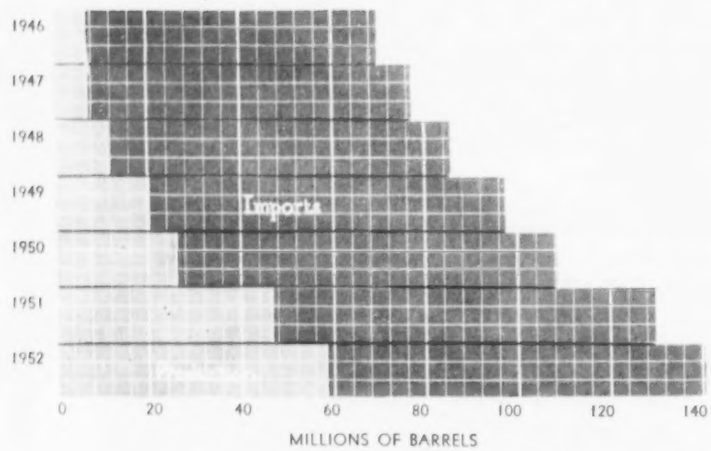
CANADIAN OIL CONSUMPTION REFLECTS

growing national prosperity



Canadian oil imports have been largely unchanged in the past thee years as increased domestic production has taken care of growth in demand.

THE YEAR 1952 was one of great prosperity for Canada and records for the first quarter of the current year indicate that the boom is continuing. The rate of growth in business probably will not be quite as great in 1953 as in 1952, but it will, nevertheless, be highly satisfactory.

Canada's productive capacity in oil, mining and manufacturing is continuing to rise. Gross national product was up seven percent in 1952 to $23,000 million. The cost of living is going down and purchasing power of the individual is rising. Immigration is on the increase and the Dominion continues to invite foreign workers to swell the population. Labor income rose 12 percent in 1952 with higher employment and wages both contributing.

Natural resource development was responsible for much of Canada's prosperity this past year. Over a million horsepower of new hydroelectric capacity was placed in operation. An additional 860,000 hp will become available in 1953. Progress was made in the mining of base metals, but the precious metals continued to lag. Rail connections are being pushed to the Ungora iron ore deposits and the Kitimat aluminum development. Iron ore production rose 11 percent in 1952. Uranium, titanium and other scarce metal mining is on the boom. Mineral production value increased $33 million to $1,278 million in 1952.

Canadian industry in recent years has based its growth largely on natural resource development, processing the products of forest and mine. This trend is continuing.

Exports currently are tending to sag. Much of this is due to the current premium on the Canadian dollar which makes it more difficult for Canadian goods to meet foreign competition. As a whole the economy is expanding rapidly.

Results of this expansion are clearly visible in the Canadian oil business. Domestic demand for petroleum and its products rose 10.8 percent in 1952 to 452,300 b/d. This compares with an increase of 14 percent in 1951 and 1950.

All principal products of petroleum have participated in the rising demand trend. Heavy fuel demand has doubled since the close of the war. Consumption has shown the following trend:

Year	Barrels
1946	17,294,303
1947	20,341,966
1948	22,307,932
1949	23,602,721
1950	26,972,647
1951	32,030,662
1952	33,404,000

An even more spectacular increase in consumption of light fuels has been enjoyed by the Canadian industry as home owners have turned to oil heat. The number of domestic oil burning furnaces and boilers has increased nearly tenfold since 1945. The oil burner and distillate fuel consumption is about as follows through 1951:

Year	Domestic Burners	Domestic Fuel Cons. (Barrels)
1945	46,000	4,700,000
1946	115,000	9,970,000
1947	166,000	16,250,000
1948	187,000	17,000,000
1949	251,000	18,700,000
1950	361,000	24,660,000
1951	424,000	29,800,000

It is estimated by the economics department of Imperial Oil Ltd. that there were 1,070,000 homes in Canada heated by oil in 1952 compared with 910,000 the previous year. Homes heated with oil furnaces totaled 509,000, and with oil stoves 538,000.

This trend may be retarded within the next two years if the Trans Canada gas line is built to bring western gas to Ontario and Quebec for domestic heating. Coal at Toronto now costs $25 per ton and

...THE GREATER the DEPENDENCE ON EXPERIENCED MEN

To carve a pathway for an oil pipeline, and lay the pipe in place, demands tremendous mechanical power—giant ditchers . . . burly "Cats" . . . specialized welding machines . . . coat-and-wrap machines . . . a fleet of trucks, large and small. Yet without skilled human direction, all this equipment would be useless.

Anderson International Contractors Limited, which this year will lay approximately 300 miles of pipe across Western Canada, is the Canadian arm of the largest construction company in the world specializing in pipeline work.

Though wholly Canadian-operated, Anderson International is backed by the resources and "know how" of Anderson Bros. of Houston, Texas—a name recognized by oil men in both North and South America as the one to call on for the "impossible" in pipeline construction.

CARL C. ANDERSON

CARL C. ANDERSON, president of Anderson Bros. of Houston, Texas, and its subsidiaries, took only ten years to create what is now an international giant in its own field. From a small company based in Houston, he has extended the Anderson organization across the United States; into South America; and into Canada.

He is especially interested in the Canadian operation, for he feels that the industry in Canada will extend far beyond the most liberal expectations of today; and that pipelines are destined to carry commodities unheard of in present-day use.

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domestic fuel oil 17 cents per gallon. At these prices gas at $1.25 per thousand cubic feet would be competitive and this rate is said to be feasible.

The long pipe line for domestic as well as industrial supply is considered possible even with wide fluctuations in seasonal demand. Very large underground storage is available in the present gas fields of southwest Ontario. It is estimated that 20 to 60 billion cubic feet of gas could be placed in nearby gas fields for peak winter use. Suggestion also is made that the Ontario fields can be overproduced temporarily while the western line is being built. This would help build a load while the western gas is being brought in.

Diesel fuel demand in Canada rose 9.5 percent in 1952 to 8,973,000 barrels. Dieselization of railroads in Canada is progressing at a rapid pace and industry is turning to diesels for power in many areas remote from hydroelectric energy.

Demand for motor gasoline rose 14.5 percent in 1952 to 62,791,000 barrels. In 1952 Canadian consumption of motor gasoline was 54,909,000 barrels, and in 1949 the total was 49,592,000 barrels.

The rising trend in Canadian imports of crude oil was halted in 1952. The increase in domestic demand was matched almost exactly by the increase in domestic production.

There was a considerable shift in the source of foreign oil received by Canadian refineries. Venezuela enjoyed a far greater share of the Dominion business while Middle East imports fell sharply.

Sources of foreign crude oil received in 1952 and 1951 are shown below:

Country	1952 (Barrels)	1951 (Barrels)
Venezuela	51,016,652	45,169,569
United States	20,056,275	21,077,568
Arabia	8,379,867	13,418,864
Trinidad	1,832,704	1,941,295
Borneo	859,772	1,291,852
Mexico	322,052	.....
Ecuador	.....	240,425
Total	82,467,322	83,139,573

Domestic crude production in 1952 totaled 61,210,466 barrels, an average of 167,645 b/d for an increase of 28 percent over the 47,615,534 barrels or 130,454 b/d produced in 1951. Potential production at the beginning of the year was 205,000 b/d, and at the end of the year 300,000 b/d.

Producers increased known crude reserves during the year by 302,909,000 barrels to 1,679,509,000 barrels. Natural gas liquids reserves increased 54,026,000 barrels to 65,374,000 barrels in 1952. Saskatchewan increased its reserves five-fold during the year to 124 million barrels.

Details of changes in reserves are shown in the accompanying tabulation which was prepared by the Committee on Crude Oil Reserves of the Canadian Petroleum Association. Members of the committee include: Messrs. G. A. Connell, Royalite Oil Co., Ltd., chairman; W. B. Dingle, Imperial Oil Ltd., vice-chairman; R. W. Diamond, Canadian Petroleum Association, secretary; E. C. Cudby, The California-Standard Co.; A. E. Keller, Texaco Exploration Co.; B. R. Leeds, Socony-Vacuum Exploration Co.; and B. I. Routh, Canadian Gulf Oil Co.

The expansion of leasing and exploration in the period is indicated in the following tabulation:

Year	Leases and Reservations (Millions of Acres)	Geophysical Parties in Field
1946	20	11
1947	30	23
1948	56	59
1949	115	105
1950	131	125
1951	168	155
1952	214	189

Canadian self-sufficiency in petroleum reached 37.3 percent in 1952, compared with 32.4 percent in 1951 and 9.14 percent in 1946. It is anticipated that production will continue to rise at a faster rate than demand again this year.

An accompanying chart shows the trend of consumption of domestic and foreign crude by Canadian refiners in recent years.

It will be noted that as late as 1947 domestic crude consumed totaled only 6,892,000 barrels, while imported crude runs were 10 times as great, totaling 69,828,000 barrels. In 1952 domestic crude was up to 58,894,631 barrels, an increase of 52 million barrels, while foreign crude receipts had risen only 12,639,000 barrels.

Crude processed by Canadian refineries increased 31,000 b/d in 1952 to 379,000 b/d. Runs in 1951 had averaged 348,000 b/d. The increase of nine percent in crude runs was approximately in line with the rate of growth in domestic demand so that the Dominion found it necessary to continue imports of refined products at about the same rate as before.

Capacity of Canadian refineries was increased 39,000 b/d in 1952 but a good deal of the new capacity did not become available until late in the year. Hence, crude runs did not expand as much as the growth in rated capacity.

Note: The editors of WORLD PETROLEUM acknowledge with thanks the generous assistance of John F. Fairlie, manager of the Co-ordination and Economics Department of Imperial Oil Ltd., in supplying data for the above article to supplement current figures of the Dominion Bureau of Statistics.

PROGRESS TOWARD SELF SUFFICIENCY
(Thousands of Barrels)

Year	Production	Needs	Percent Sufficiency
1946	7,607	80,968	9.4
1947	7,729	98,943	8.1
1948	12,368	105,082	11.8
1949	21,487	114,426	18.8
1950	29,058	130,460	22.3
1951	48,123	150,400	32.4
1952	61,790	166,000	37.3

CANADIAN MOTOR VEHICLE REGISTRATIONS

Year	Cars	Trucks & Buses	Total Motor Vehicles
1935	989,744	174,623	1,164,367
1940	1,234,637	250,550	1,485,187
1945	1,160,058	319,609	1,479,667
1950	1,650,641	544,288	2,194,929
1951	2,070,000	690,000	2,765,155
1952	2,242,200	756,800	2,999,000

CANADIAN SUPPLY AND DEMAND FOR OIL
(Thousands of Barrels Daily)

Demand	1950	1951	1952
Total Demand	359.0	410.6	460.3
Exports	1.1	2.2	8.0
Domestic Demand	357.9	408.4	452.3
Supply			
Crude Petroleum	78.4	130.3	167.2
Additives (1)	5.0	8.9	8.6
Crude Imports	224.1	227.8	225.3
Product Imports	63.0	67.0	73.7
Total Supply	370.5	434.0	474.8
Inventories			
Stock Changes	+11.5	+23.4	+14.5

(1) Additives include Domestic Natural Gasoline and field plant production of Propane and Butane.

ESTIMATED PROVED RESERVES OF LIQUID HYDROCARBONS IN WESTERN CANADA
(Thousands of Barrels)

	Proved Reserves as of 12/31/51 (1)	Changes in Proved Reserves Due to Extensions (New Oil) and Revisions during 1952 (2)	Proved Reserves Discovered in New Fields and in New Pools in Old Fields, 1952* (3)	Production During 1952 (4)	Proved Reserves as of 12/31/52 (Columns 1+2+3 less Column 4) (5)	Changes in Reserves During 1952 (Column 5 less Col. 4) (6)
Crude Oil						
Alberta	1,328,000	57,842	198,914	58,367	1,526,389	198,389
Manitoba	500	——	1,724	119	2,106	1,606
Saskatchewan	21,000	3,125	101,822	1,700	124,247	103,247
Northwest Territories	27,100	(—) 19	——	314	26,767	(—) 333
Total Crude Oil	1,376,600	60,948	302,461	60,500	1,679,509	302,909
Natural Gas Liquids**	11,348	39,675	14,970	619	65,374	54,026
Total Liquid Hydrocarbons in Western Canada	1,387,948	100,623	317,431	61,119	1,744,883	356,935

*Only a limited area is assigned to each new discovery, even though the committee may believe that eventually a much larger area will produce, because in this report the committee is concerned only with actually proved reserves. Hence, figures in this column may be considered minimum figures.

**All natural gas liquids are located in Alberta.

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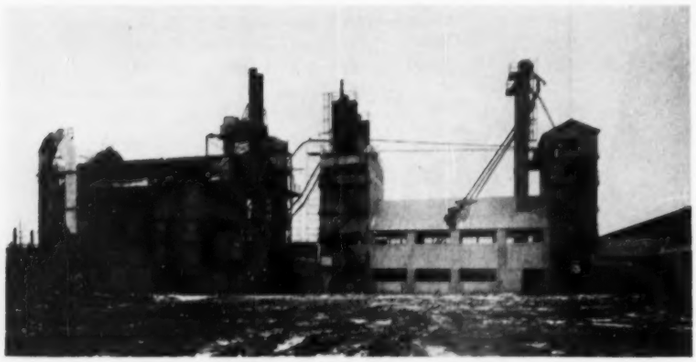
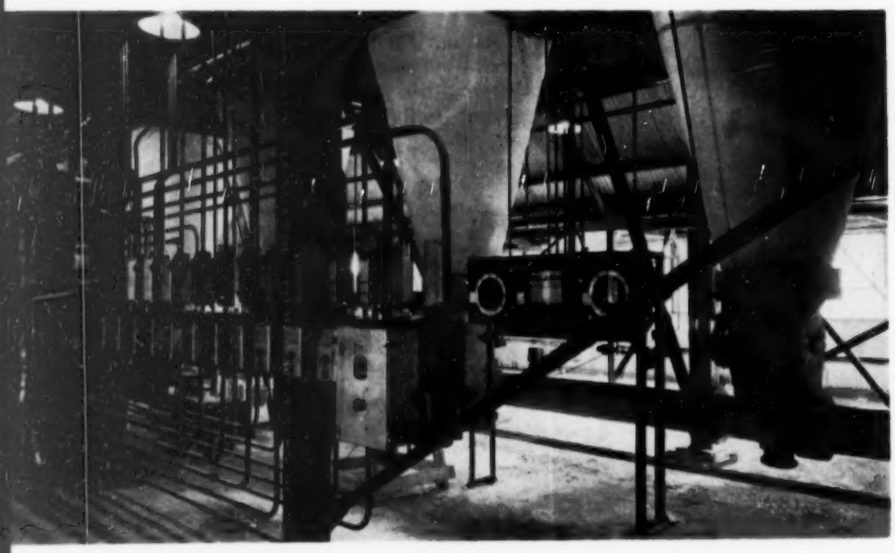
General view of collection equipment (left) and process area (right).



Cabot builds Canada's first oil furnace black plant

Interior view of bag filter building. Bag filter cones with air lock and line carrying carbon black to primary cyclones.



COMMERCIAL operations of the first oil-furnace carbon black plant in Canada were recently started at Sarnia, Ontario. This event marks an important point in the industrial development of Canada, because it permits use in the manufacture of Canadian tires and other rubber products of still another Canadian basic material.

Construction of this oil-furnace carbon black plant began in the early spring of 1952. The manufacturing methods are similar to those used by Cabot Carbon Company in the United States. The principal process equipment was designed by its subsidiary, Cabot Engineering Company of Pampa, Texas. Stone & Webster Canada Limited, with the assistance of Stone & Webster Engineering Corporation, Boston, furnished consulting services and were responsible for the overall management of the construction project. Many of the buildings were designed by the Toronto engineering firm of Proctor, Redfern & Laughlin. Part of the process equipment was supplied from the United States, but the major portion was built in Canada.

The new plant, which will employ a total of about 50 people, is situated on the southern outskirts of Sarnia. The site occupies an area of about 15 acres and adjoins the plant site of Fiberglas of Canada. Both of these plants lie across from the huge plant of Polymer Corporation Limited, where synthetic rubber of various types is produced. Polymer Corporation's plant at Sarnia is the only synthetic rubber plant in the British Empire, and its output represents a notable percentage of the synthetic rubber production of the free world.

The plant site of Cabot Carbon of Canada is well situated with regard to highway and railroad transportation. It is serviced by a spur of the Canadian National Railways and within close distance of the main highways leading east and south.

The new plant, when in full operation, will have an annual production capacity of 50,000,000 lbs. per year of carbon blacks. It specializes in the production of two basic types of carbon black known under the trade designations of "Sterling SO"—FEF, which is a fast extrusion type of furnace black for use in tires and extruded rubber goods, and "Vulcan 3"—HAF, which is a high abrasion carbon black, especially used in compounding rubber for tire treads.

No natural gas, but only special petroleum oils, will be used as charge stock for the carbon black plant. At present, this charge stock is imported from the United

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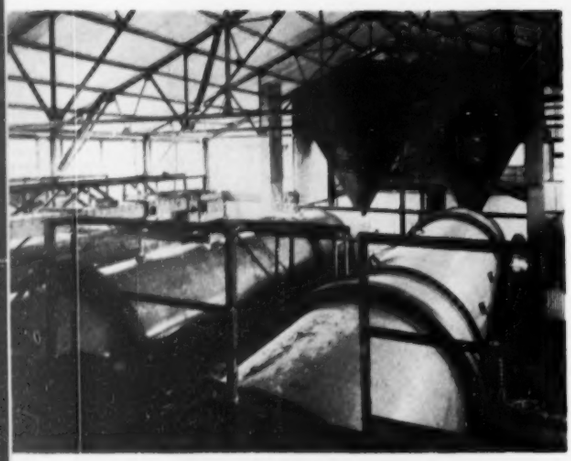
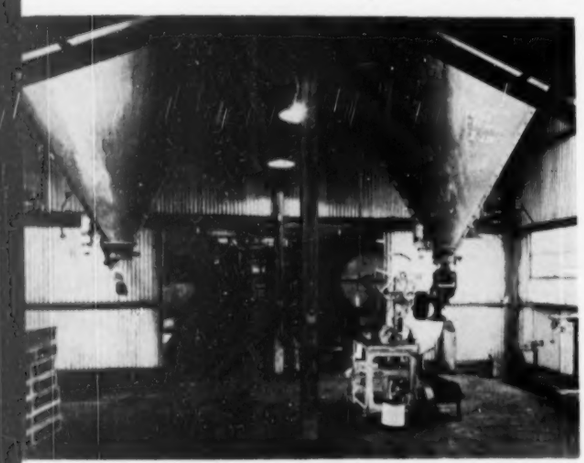


Interior view of process building. Pelletizing drums and bag packing tanks.

States and arrives in barge load shipments during the period of open navigation, which normally extends from April 15 to December 1. The barges are unloaded at the Polymer Corporation's dock on the St. Clair River. From there, oil is pumped through an insulated pipe line, over the Polymer Corporation right-of-way, into two large storage tanks located at the plant site. It is hoped that the type of petroleum oil which is required as charge stock can be secured from local refineries in the future.

The processes for manufacturing the two kinds of carbon black produced at Sarnia are based on numerous patents issued or pending. These patented processes are either owned by Godfrey L. Cabot, Inc. and its subsidiaries, or are under obtained license agreements. Thus the plant design and manufacturing methods used incorporate the experience gained in constructing and operating many furnace carbon black plants. Two distinct processes are used for the production of the two types of carbon black. Basically, both provide for the controlled combustion of preheated oil charge in special reactors, with combustion air supplied under blower pressure. The oil is transferred from storage tanks to daily charge tanks and flows through filters to motor driven feed pumps. It is preheated in indirect heaters of the molten salt bath type, and then flows to the burners of the reactors. The oil charge circulates through a loop line which permits the return of a portion of the oil to either the charge tank or the intake side of the feed pumps.

Bag packing room. Pelletizing drums in background.



The oil is burned in the reactors with a controlled quantity of air and the resulting combustion gases flow through long horizontal cooling tubes. Before entering these cooling tubes, the temperature of the combustion gases is reduced from about 2,700° F to approximately 1,000° F by means of a water quench. The cooling effect obtained in the long horizontal cooling tubes, which are exposed to the atmosphere, lowers the temperature of the combustion gases to about 700° F. They are further cooled to about 500° F in a vertical gas cooler equipped with internal water sprays and then enter a series of cyclone separators where a large portion of the furnace black, which is formed by the incomplete combustion of hydrocarbons under controlled conditions of temperature and air deficiency, is partially separated.

Leaving the cyclones, the gases pass through a second vertical gas cooler where the temperature is lowered to below 300° F. Finally the gases, with their suspended carbon, flow through bag filters which separate and retain the black.

The actual plant arrangement provides for two parallel trains of production equipment, each train comprising reactors, coolers and complete collection equipment, including bag filters. The combustion products, which include all the carbon black formed, are subjected to multistage separation in four cyclones, arranged in series. The gases leaving the last cyclone are picked up by an exhaust fan and blown through a secondary gas cooler into bag filters. The residual gas leaving the bag filters is exhausted to the atmosphere through stacks.

The carbon black recovered in the bag filters accumulates in conical bottoms and, after passing through rotating air locks, is blown back into the first stage of the cyclone-separators, where it rejoins the bulk of the carbon black production that is recovered therein.

The bag filter installation contains 14 compartments arranged in two groups to permit the simultaneous handling of the two distinct types of carbon black that are produced at Sarnia. The bag filters are remarkable for their completely automatic time cycle operation, controlling the repressuring and shaking steps of each individual bag filter compartment. The cloth of the bag filters is made of Orlon.

The entire carbon black production which finally collects in the bottom cones of the cyclones is blown by carrier air into pneumatic cyclones which discharge the carbon black through pulverizers into agitator tanks. The fluffy carbon black flows from the bottom of the agitator tanks through vari-speed conveyors into pelletizing drums where the carbon black is shaped into small free-flowing pellets. This form greatly facilitates the packaging, handling and shipment of carbon black. The pelletized material goes over magnetic separators and vibrating screens into bagging tanks, of which there is one for each train. The bag storage tank serves for the packing of the pelletized carbon black into multiwall paper bags which operation is handled in special bag filling machines. Alternately, the pelletized carbon black may be conveyed to a Berquist tank for the bulk loading of special hopper type railroad cars for shipment to companies having suitable unloading and handling facilities.

A series of auxiliary bag filters is provided for the recovery of carbon black which the stream of carrier air transfers from the cyclones to the pulverizers and agitator tanks. These filters, though of smaller capacity, are of the same type as the large bag filter installation and the carbon black recovered therein falls by gravity into the agitator tanks.

The carbon black plant is equipped with a large warehouse, where bagged carbon black will be stored for shipment by railroad or truck, a bag printing installation, maintenance shop, material storage and service building, bathhouse and combination office and laboratory building.

All technical and administrative activities of Cabot Carbon of Canada Ltd. will be centered at the Sarnia plant, 350 Wilton Street. Sales will be directed from the principal sales office at Toronto. A branch sales office is also maintained in Montreal.

The basic layout of the plant allows for duplication of facilities, since sufficient room is left for future extension.

The nearby plant of the Polymer Corporation Limited furnishes the steam and the process water required in the carbon black plant. Domestic water is supplied by the City of Sarnia and electricity by The Sarnia Hydro-Electric System.

The plant does not produce any refuse and its manufacturing and handling facilities have been designed to insure cleanliness of operation and to prevent pollution of the atmosphere or the surface drainage water.

In recent years, the City of Sarnia has been the scene of a stupendous industrial development centered mainly around the processing of petroleum and the manufacture of basic chemicals and synthetic rubber. The operations of the Cabot carbon plant are a noteworthy contribution to the important and interdependent industrial activities which are so vital to the economic growth of Canada.

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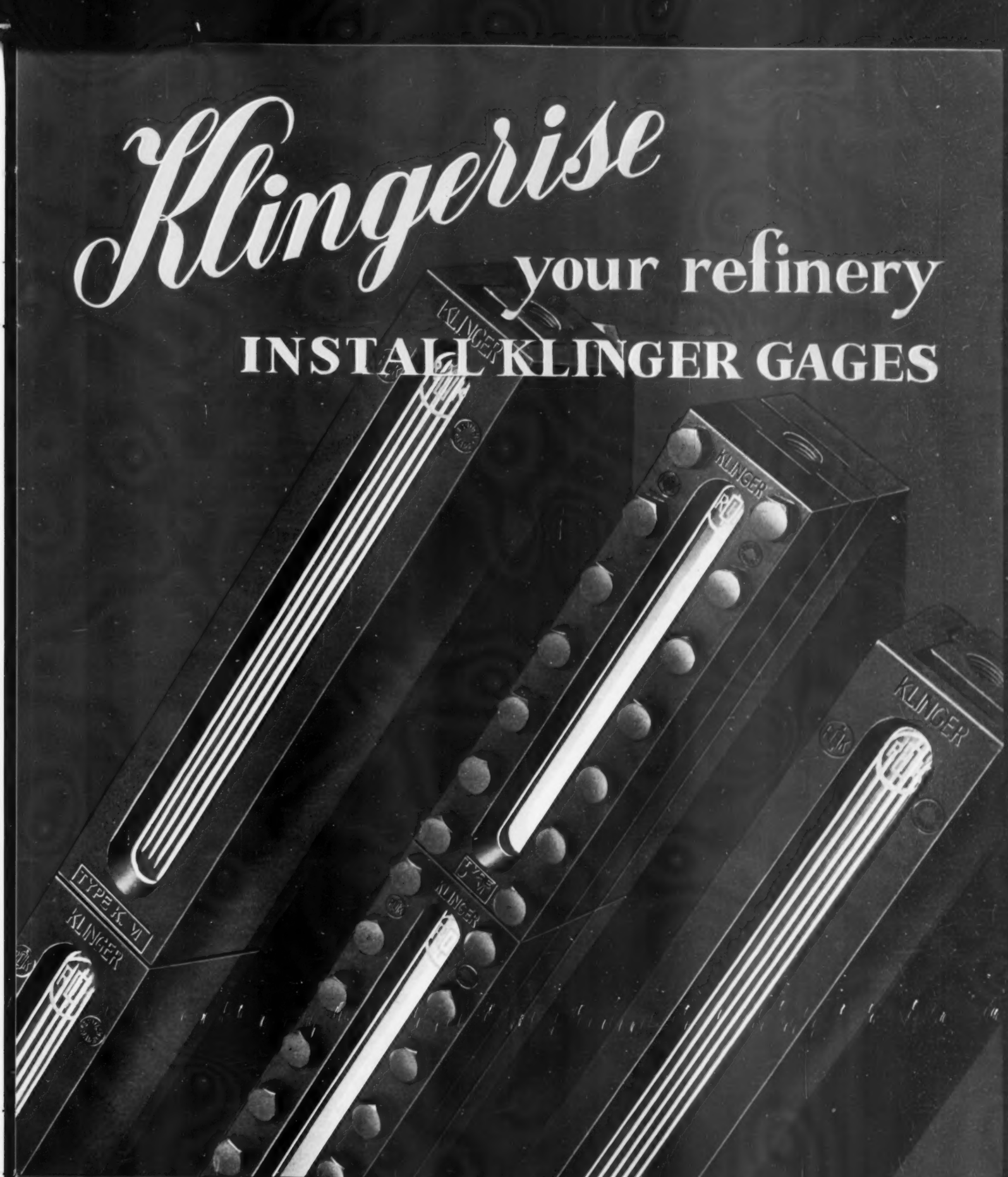

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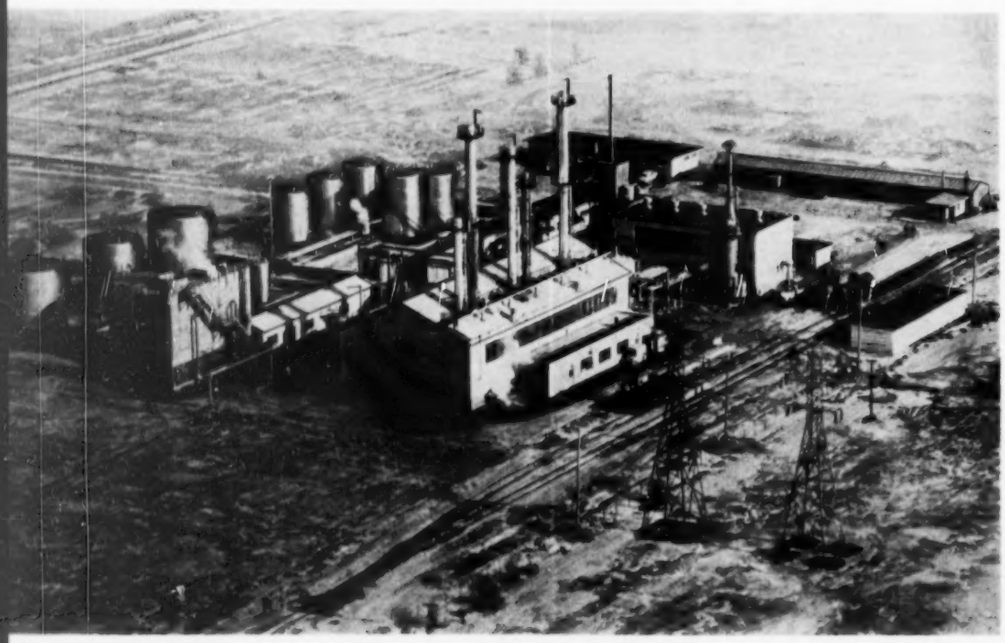
Shell's Montreal Chemical Plant

G. S. Williamson was named superintendent of Shell of Canada's Montreal petrochemical plant in January 1952, when construction of this unit was in its early stages. In this capacity he was able to follow all phases of the construction to completion, and at the same time supervise the training of personnel for the operation of the new plant. Mr. Williamson joined Shell in British Columbia in 1936 as a laboratory helper at Shellburn refinery, following graduation in Chemical Engineering from the University of British Columbia. Successive promotions led to his appointment as assistant refinery manager at Shellburn early in 1951, and his present appointment in 1952.



By G. S. Williamson

CANADA'S first production of isopropyl alcohol on a commercial scale is now underway at Shell Oil Company of Canada's new petrochemical plant near Montreal. This plant, the first petrochemical plant to be owned and operated by an oil company in Canada, is situated adjacent to Shell's Montreal East Refinery. Ground was broken for the project in April 1952 and less than one year later the plant was placed on stream. As well as isopropyl alcohol, acetone is also being produced, the combined production approximating 20,000,000 lbs. per year.

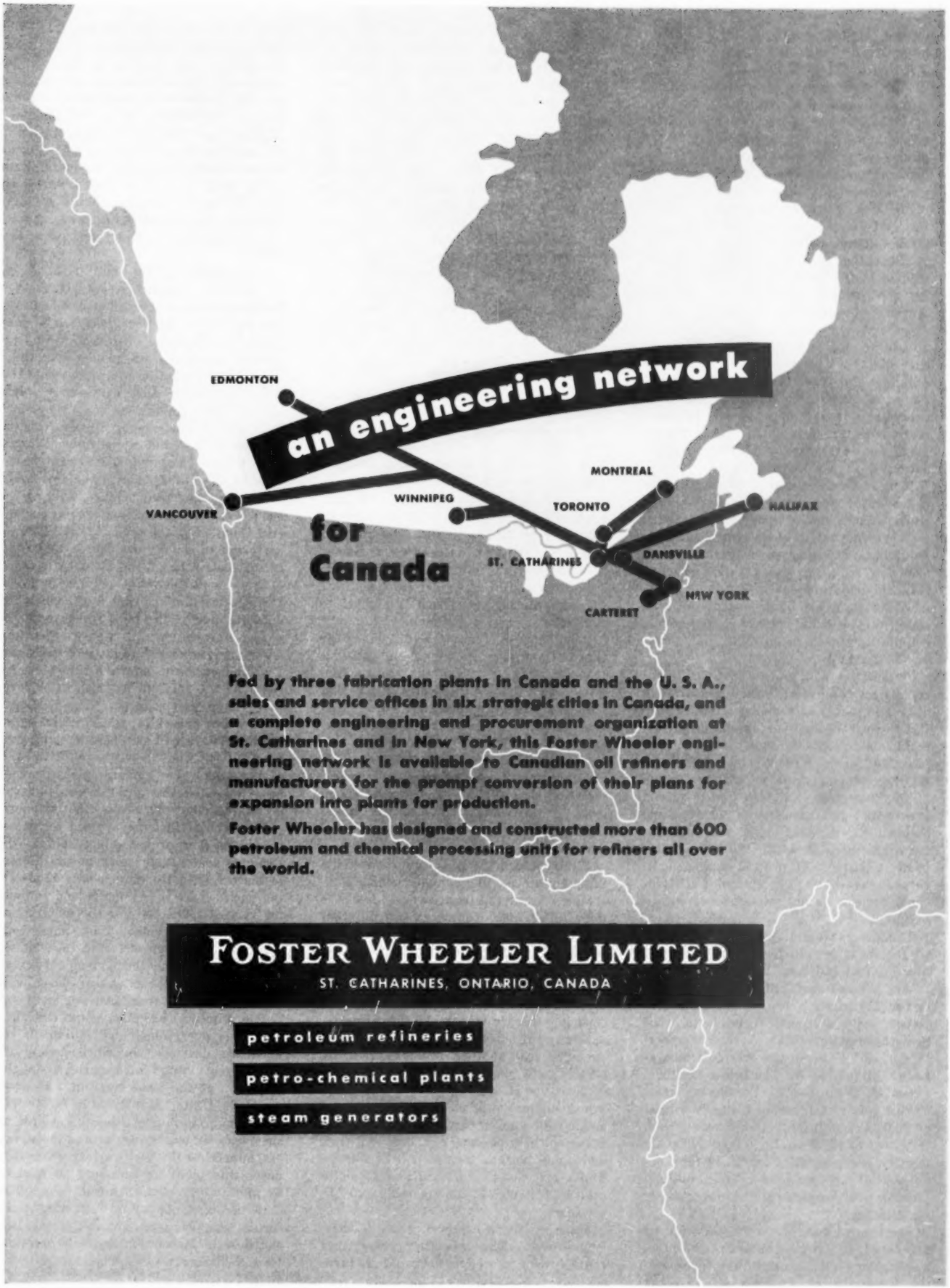
Feed to the plant consists of a liquid mixture of propane and propylene, produced from Shell's adjacent catalytic and thermal crackers. The first step in the process is the reaction of the propylene with sulfuric acid. As this step is strongly exothermic, coolers are provided for removing excess heat. The ester thus formed is subsequently hydrolyzed by dilution and mixing with water, forming crude isopropyl alcohol in a mixture with dilute sulfuric acid. The unreacted propane is caustic-scrubbed, dried and subsequently sold as LPGas. The separation of the crude isopropyl alcohol from the dilute acid is accomplished by stripping, using steam as the stripping medium.

Dilute sulfuric acid leaves the bottom of the stripper and is subsequently reconcentrated in a Chemico drum concentrator and returned to the system.

The next step in the process, which involves distillation, removes isopropyl ether formed as a reaction by-product, and reduces the water content of the crude isopropyl alcohol to about 13 percent by weight, approaching the constant boiling point mixture.

For the production of acetone, isopropyl alcohol is catalytically de-hydrogenated in a Petrochem furnace. The crude acetone, formed by the removal of hydrogen from the isopropyl alcohol molecule, is separated from the reaction by-products and purified

Mrs. Louis St. Laurent, wife of the prime minister of Canada, officially opened this new Shell petrochemical plant at Montreal East, April 14.



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to 99.5 percent by weight purity or better by means of a scrubbing step followed by distillation.

For the production of finished isopropyl alcohol, two steps are required. The first of these consists of an azeotropic distillation in which the water content of the alcohol-water mixture is reduced to approximately one percent. Finished isopropyl alcohol is then produced by final distillation which serves to remove materials boiling below and above the pure alcohol boiling point.

The entire operation is highly instrumented in the interests of precise operating control and to reduce manpower requirements. Reaction, hydrolysis, stripping and all distillation equipment is housed in one large building. The acid concentration equipment occupies another building and transfer and cooling tower pumps a third. An adjacent tank farm provides storage for rundown, intermediate and finished products. Shell Turbogrids are used in many distillation applications.

In an enclosed process of this nature, the collection of pump drips and of the blowdowns from gauge glasses and sample pots is of importance both from the standpoint of minimizing vapor evolution and also for reducing losses. Hydrocarbon and acid drips and blow-downs in all buildings are gathered by means of enclosed collection headers connected to sumps equipped with level-controlled pump-outs to storage tanks.

Winterizing of a process designed to operate in a climate of severe temperature fluctuations and at the same time requiring the use of many high-freezing-point materials presented unique problems. The Montreal plant is designed to operate in weather temperatures as low as minus 20° F. The plant is divided into two basic areas: the hazardous area where some flammable vapors may exist and the non-hazardous area in which the fired equipment is located. All process equipment in these areas, with the exception of a Petrochem furnace, is entirely enclosed within buildings.

The process building is approximately 65 feet wide by 140 feet long by 28 feet high. The building has a rigid steel frame, pitched roof and trafford tile roof and siding above a brick wainscote. Projection type unit-heaters near the roof heat the building to an average temperature of 40° F. when the outside temperature is minus 20° F. The heating is thermostatically controlled. Ventilating units at the ends of the building supply a total of 65,000 cf/m of outside air year round, tempered to 40° F. in the winter. The air is exhausted near the floor by 12 fans, six on each of the two sides of the building, providing a complete air turnover every six minutes.

The control building is 20 feet wide by 118 feet long. It is attached to the process building and divided into three sections; a central control room for both the reaction and distillation process adjoining the process building and connected with sufficient windows to allow vision of the process equipment from inside the control room; a control laboratory on one end and a utility room on the other. The utility room houses the instrument air compressor and dryer, the ventilating equipment and water heater. This entire section is ventilated with filtered outside air distributed to each room. The total air-quantity is 3,000 cf/m in the winter, and 600 cf/m in the summer. The building is pressurized year around.

The acid recovery plant located in the non-hazardous area houses a two stage Chemico unit, affiliated pumping, acid blending and cooling equipment and a control room. The acid mist precipitator and substation are located adjacent to the main building. The precipitator is designed to effect the removal of 93 percent of the sulfuric acid mist entrained in the effluent steam and furnace stack gases. The elimination of a public nuisance rather than economic considerations is the justification for this installation. The concentrator building is 40 feet wide by 78 feet long by 30 feet high. The building has a precast reinforced concrete frame, precast concrete roof and trafford tile siding above a brick wainscote. The heating and ventilation system is similar to that of the process building.

A pumphouse is situated adjacent to the tank farm area and houses all product transfer pumps, some of the process feed pumps and the cooling water circulating pumps. Thermostat-controlled unit heaters maintain a 40 degree temperature during minimum winter temperatures.

Outdoor installations of instruments are protected from the weather by sheet metal enclosures heated by internal steam coils. All instrument boxes have adequate access doors or panels for operation and maintenance.

Winterizing of cooling towers presents unique problems in a climate such as Montreal's. A two-cell induced draft tower is used. The fans operate at two different speeds to meet various winter conditions and also are equipped with a reversing switch to enable the towers to be de-iced by means of a downward flow of air. Removable wooden panels are provided for covering the air louvers in the winter.

Storage of sulfuric acid at minus 20° F. presents still another problem—freezing of acid with insufficient heat or accelerated corrosion if overheated. All acid tanks are insulated and heated with external steam coils located between tank pier supports with sufficient gap between coils and tank bottom to prevent hot spots. Tanks are heated and insulated to maintain acid at 60° F. during minus 20° F. weather.

Much attention has been given to safety features. The separately pressurized control room, as well as the rapid air turnover in the process and concentrator buildings, minimize the exposure of operators to fumes. The portion of the reaction equipment which circulates acid mixtures at high pressures is separated from the rest of the building by a high bulkhead. Windows are installed for observation of the equipment and operating and dropout valves extend through the bulkhead. Many of the pump glands and process valves are provided with shields to contain leaks. An elaborate alarm system has been installed to call attention to faulty operating conditions.

In a plant handling dilute sulfuric acid at elevated temperatures and pressures, the battle against corrosion is an unceasing one. The Shell organization's many years of experience in designing and operating petrochemical plants was called upon for the solution of many tricky corrosion problems. Such materials as high-silicon iron, Monel, carbon, Chlorimet, Lebanon 34, Colomonoy, Hastelloy, tantalum, teflon, lead and copper have all found use. Where concentrated acid is stored in unlined steel tanks, advantage was taken of a process termed "chilled welding" to reduce groove corrosion commonly experienced adjacent to welds. This type of corrosion is usually considered to be due to spheroidizing of the steel as a result of the heat generated during welding. "Chilled welding" consisted of cooling the opposite side of the tank from which the welder is working with a spray of water, while using a low-hydrogen mild steel rod. By this means, the length of time at which the steel was held in the critical temperature range was reduced. The first seal weld, which must be applied without water cooling, is chipped out before being covered by subsequent passes on that side of the tank. Tests on sample specimens have indicated that groove corrosion can be appreciably reduced by this procedure.

The type of instrument used for measuring the flow of hot dilute acid to the Chemico concentrator may be of interest to those faced with the problem of metering such streams. A Magnabond rotometer is used. The body of the meter is of lead-lined steel protected by impervious graphite. A carbon metering tube houses a teflon float, with the metering edge of tantalum. The float extension rod is made of pyrex glass-covered Hastelloy.

The Montreal chemical plant embodies numerous operational and equipment refinements developed by Shell during almost twenty years of experience in the operation of the basic steps of this process in the United States and in the United Kingdom. The highest possible degree of chemical engineering design and the strictest adherence to high safety standards make this plant as safe and as modern as any in the petrochemical field. The C. F. Braun Company of Alhambra, California was engaged for equipment layout, design, fabrication and field erection. Process design was by Shell.

Canadian Petrochemicals

(Continued from page 142)

In the new $4 million BA-Shawinigan plant which was built for the two companies by Canadian-Kellogg Co., propylene from the British American refinery is alkylated with benzene to form cumene. This is in turn oxidized with air to form a peroxide which decomposes to phenol and acetone. An important feature of the process is that scarce chlorine is not required. Production of the plant may be limited somewhat by the available market for by-product acetone. When the plant was projected, there was no production of acetone in the Dominion. Shell Oil Co. soon will have a considerable quantity to sell at its new alcohol plant at Montreal and acetone also will be produced in large quantities at western petrochemical plants. Details of these two plants are given elsewhere in this issue.

The Shell alcohol plant which went on stream recently was built by C. F. Braun and Co. at a cost of $3 million. It will produce 13.5 million pounds of isopropyl alcohol and seven million pounds of acetone per year. Propylene from the refinery gas concentration plant is the raw material. The process employed is the same as that used at Shell refineries in the United States.

Still a third petrochemical plant in the Montreal area is the formaldehyde plant being erected by St. Maurice Chemicals at Varenne, Que. Production will include 30 million pounds per year of formaldehyde and three million pounds per year of penterythritol from refinery gases.

On the Western Prairies, the Canadian shortage of sulfur is being met by two plants which are processing sour gas. Royalite Oil Co. in Turner Valley and Shell at Jumping Pound are plant operators producing in the aggregate 60 tons per day.

Oldest petrochemical plant in the west is the ammonia plant at Calgary which is operated by Consolidated Mining and Smelting Co.

Three large chemical plants representing an investment of $85 million are being erected in the west to manufacture chemicals from natural gas. Largest of these is the $55 million Canadian Chemical Co. plant being built by Brown and Root of Houston.

The Canadian Chemicals plant is being built at Edmonton, Alta., and is expected to be ready for operation by the middle of this year. It will process some 35 million cubic feet of gas daily to produce a wide variety of alcohols, glycols, acetone and acetic acid, aldehydes, oxides and ketones. The plant will operate in three divisions. The basic chemicals will be produced in the first. In another acetic acid will be reacted with wood pulp to produce cellulose acetate. The third plant will produce fibers and yarns from acetone and cellulose acetate.

Canadian Industries, Ltd. also is building a plant at Edmonton to process 10 million cubic feet of gas daily for the production of polyethylene. Ethylene to be produced by cracking will be polymerized at very high pressures to produce about 6,000 tons per year of polyethylene flake. Completion is scheduled for mid year. This same company is building another petrochemical plant at Maitland, Ont., which will produce nylon salts from cyclohexane.

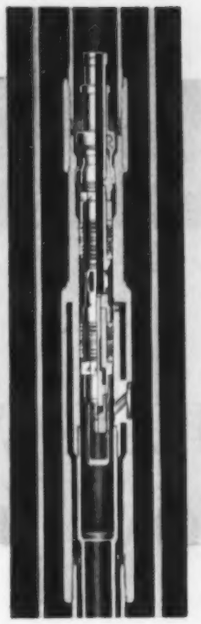
At Ft. Saskatchewan, Alta., ammonia will be produced from natural gas as a part of the Sherritt-Gordon Mines, a $17 million project.

With a gas reserve of 10.5 trillion feet now discovered and new finds being announced every week, the Western Provinces are eager to build a petrochemical industry of similar proportions to that which has been springing up on the United States Gulf Coast. The desire to build such an industry is one essential reason why Alberta government officials have hesitated to permit the export of natural gas in large quantities for consumption at distant points.

Heads Tube Engineers

Charles T. McClure, formerly with Youngstown Steel Products Co. of California, has joined The Youngstown Sheet and Tube Co. as superintendent of field engineers, tube division. Mr. McClure was with Signal Oil & Gas Co. for nine years before he joined Youngstown.

Pull a Choke Instead of Your Tubing



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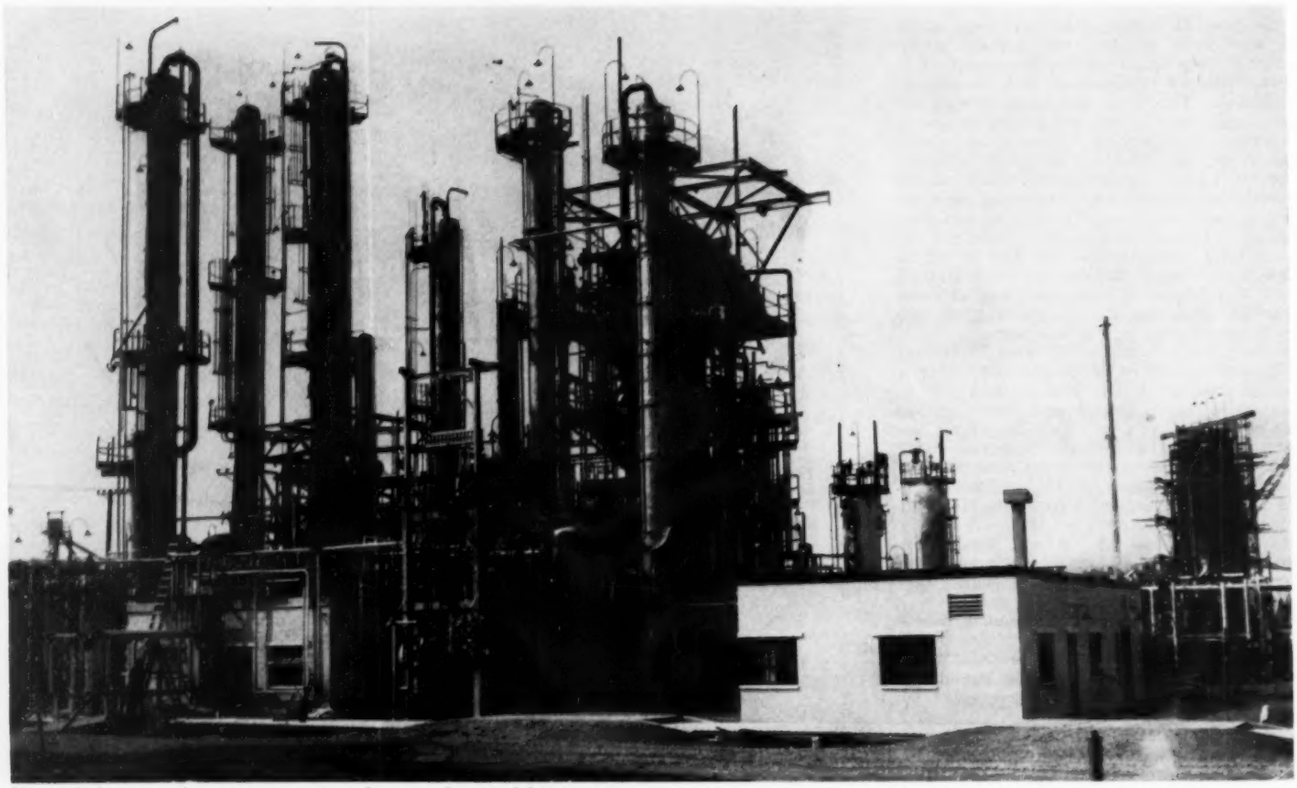


View of the general process area, pumphouse and control house at the new B.A.-Shawinigan petrochemical plant in Montreal East.

CANADA BUILDS WORLD'S FIRST PHENOL-FROM-CUMENE PLANT

THE B.A. - SHAWINIGAN petrochemical plant in Montreal East is now entering the production stage. It is the first commercial installation for the manufacture of phenol from cumene. The plant was designed to produce adequate volumes of phenol to meet Canadian national requirements. In addition, it produces nearly enough acetone to meet the demand for this commodity in Canada.

The main production of synthetic phenol in the United States from which Canada has obtained its requirements has been principally by the sulfonation and chlorobenzene processes. These methods depend on either sulfuric acid or chlorine, in addition to benzene, as basic raw materials. The cumene process requires benzene, propylene, and oxygen from the air as the principal raw materials. Byproduct formation using the cumene process appears to be less than that produced by other processes, when acetone is considered as a main product.

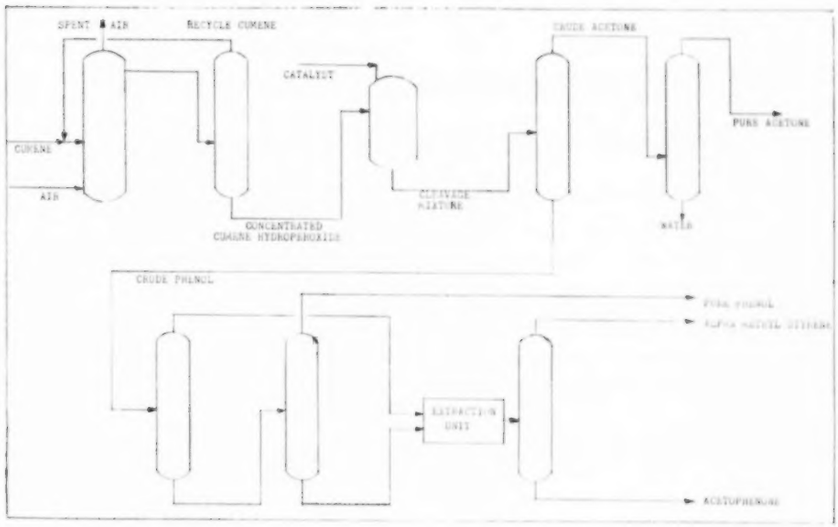
B.A.-Shawinigan Ltd. is owned jointly by the British American Oil Company Ltd., which has refineries located throughout Canada and Shawinigan Chemicals Ltd., which produces vast quantities of calcium carbide and acetylene derivatives at its plants in Shawinigan Falls, Quebec. The B.A.-Shawinigan plant is designed to produce chemicals from petroleum for consumption in Canada.

The plant covers four acres of a 21-acre site which will ultimately be required for production of other chemicals to be efficiently produced from petroleum and petroleum derivatives.

Cumene is produced in a separate plant which has been especially designed to manufacture a grade suitable for conversion into phenol and acetone. Propylene is supplied by the fractionation of refinery gases, and alkylation with benzene is carried out in a new plant constructed for this purpose.

Since each pound of phenol requires slightly less than 1½ pounds of isopropylbenzene, a moderate-sized production plant is required for this purpose. Although there were more than 20 plants for production of cumene in the United States and Canada in 1945, producing more than 14,000 barrels per day, the requirement for this material terminated at the end of World War II and most of the plants were converted to other uses.

The catalyst used for the propylene-benzene reaction is phosphoric acid supported on Kieselguhr. A propane-propylene stream is freed from sulfur-bearing compounds and is reacted with benzene at a temperature in the vicinity of 500° F. and at a pressure of about 400 psi. Some



by-products are formed as a result of this reaction and these products are separated for other applications. Production of cumene requires careful control of both raw materials and manufacture to produce a suitable product for chemical application.

The reactions involved in the phenol-acetone process, namely the oxidation of cumene hydroperoxide and particularly cleavage of the hydroperoxide with 10 percent aqueous sulfuric acid to phenol and acetone, were studied by Hock and Lang in Germany and reported in German chemical literature in 1944. The oxidation of cumene, as carried out by these workers, was relatively slow and gave low yields of the hydroperoxide; the cleavage of the hydroperoxide gave low yields of phenol. These reactions have also been studied in the United States by the Hercules Powder Co., and in England by the Distillers Company Ltd. These latter studies led to the development of a commercially attractive process which gives good reaction rates and high yields of phenol and acetone. The Hercules-Distillers process has been licensed to B.A.-Shawinigan Ltd.

The reaction of cumene with oxygen involves the addition of oxygen to the hydrocarbon to form cumene hydroperoxide. This may be represented schematically as follows:

The cleavage of cumene hydroperoxide to phenol and acetone occurs under the influence of catalytic amounts of acidic substances and is represented schematically as follows:

The process, as it is being conducted by B.A.-Shawinigan Ltd., involves oxidation of cumene with air in the presence of a suitable alkaline material at moderately elevated temperatures. The conversion of the hydrocarbon may be limited to any degree desired and unchanged hydrocarbon may be recycled with the object of obtaining higher efficiencies and lower by-product formation. Only minor amounts of by-product dimethylbenzyl alcohol and acetophenone are formed. Under properly selected conditions, the cleavage of the cumene hydroperoxide may be caused to occur almost to the exclusion of side reactions. It is conducted at slightly elevated temperatures utilizing an acidic material as catalyst. Dimethylbenzyl alcohol formed during the oxidation of cumene is converted by dehydration to α-methylstyrene.

The crude mixture of phenol and acetone, which contains, in addition to these substances, minor amounts of acetophenone, α-methylstyrene and higher phenols formed by condensation reactions, is separated into its component parts by fractional distillation. All distillations are performed continuously under carefully controlled conditions and the products are isolated in a sufficiently pure state to conform to close specifications. The phenol and acetone are obtained in commercial purities using U. S. Pharmacopoeia and British Standard specifications.

An examination of the new process in comparison with other established processes for the production of phenol appears to show distinct advantages for production by the cumene process with very few unfavorable characteristics. The process necessarily produces both phenol and acetone simultaneously from cumene and a suitable market is required for acetone to make the production of phenol economical. Since the required factors appear to be present in Canada, this process appears to have a very bright future when compared with any other well-known processes.

Pipe Lines

(Continued from page 94)

598 b/d, and to the local refinery at Superior deliveries averaged 3,023 b/d. Takeoffs from the line for Alberta, Saskatchewan and Manitoba refineries averaged 53,989 b/d.

Total revenue barrel miles was 33,652 million. Of this Imperial Oil Ltd. utilized 27,733 million barrel miles, British American 2,118 million, Lake Superior Refining Co. 1,246 million, North Star Oil Ltd. 983 million, Saskatchewan Federated Cooperatives Ltd. 865 million, Anglo-Canadian Oil Co. Ltd. 568 million, Hi-Way Refineries Ltd. 129 million and McColl-Frontenac Oil Co. Ltd. 10 million.

Crude deliveries were 39 percent higher in 1952 than in 1951 when the company carried 30,124,986 barrels a total of 24,294 million barrel miles. The line operated only three months in 1950 and delivered 2,711,223 barrels, the traffic totaling 1,574 million barrel miles.

Interprovincial reported net earnings of $4,107,689 in 1952 compared with $3,352,706 in 1951. In 1950, with only three months of operations, earnings totaled $107,148.

A third of the stock in Interprovincial is owned by Imperial Oil. Holdings early this year totaled 1,200,000 shares, or 33.36 percent of the amount outstanding. Canadian Gulf Oil Co., second largest stockholder, owned 360,000 shares.

Development of Williston Basin production in southern Saskatchewan is expected to result in the early construction of a pipe line from newly developed fields as soon as output warrants the expense. Socony Vacuum officials are quoted as saying that a line will be justified when Fosterton area production reaches about 10,000 barrels daily. Socony has a large drilling program for the year designed to accomplish this end. The company may drill as many as 175 wells. The proposed line would be approximately 175 miles in length and would tie into the Interprovincial system at Regina.

In 1952, two important feeder lines were constructed in Western Canada. Saskatoon Pipe Line Co., Ltd., built a 56-mile line to tap Interprovincial at Minden, Sask., and provide crude for the Hi-Way refinery at Saskatoon. The line is six inches in diameter with a daily capacity of 12,000 barrels.

Second important feeder was the $5 million system built by Canadian Gulf Pipe Line Co. to bring crude from the Big-Valley-Fenn-Stettler area to the Interprovincial terminal at Edmonton. This line is 115 miles in length. Between Stettler and Edmonton 12-inch pipe was laid. Smaller lines were extended to Big Valley and Fenn fields. The line has a capacity of 35,000 b/d, giving considerable room for increase in crude movement over the present production of the fields served.

Dependence upon water transportation for petroleum products was decreased in the populous Hamilton-Toronto area in 1952 by the completion of two major products lines. One line brings products of Montreal refineries to consumers while the other delivers motor fuel and other principal refined oils manufactured from Prairie or mid-continent crudes at Sarnia. In 1953, a third major products line will be built. It will link the new Sun Oil Company refinery at Sarnia with Toronto markets.

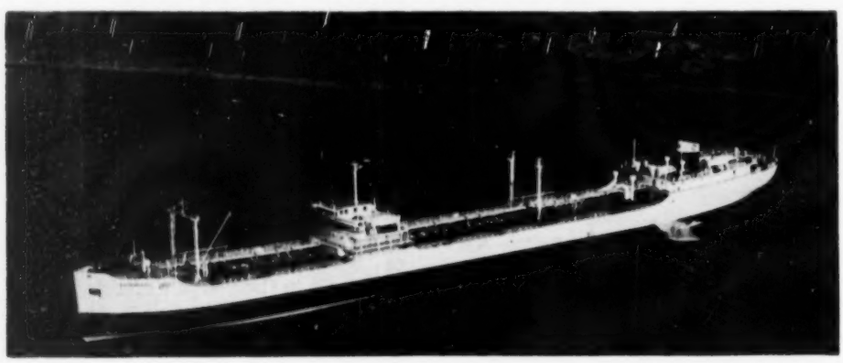
Sun's new line will be completed in October in ample time for this year's winter freeze-up. It will be ready for operation some time in advance of the completion date for the Sarnia refinery.

At present, Sun has a products line from its United States refinery at Toledo to Sarnia. When the new refinery is built this products line will be converted to a crude carrier. It will supply raw material for the Canadian refinery through connections with southwestern United States fields, at least for the immediate future.

Conversion of the products line to crude will require Sun to build a new products line to Detroit where Sun has a large distribution. This will be a 45-mile line costing about $1,300,000.

The Canadian products pipe line from Sarnia to Toronto will be about 200 miles in length and will cost $5 million. Plans are to lay eight-inch pipe and to build only one pump station at the outset. This will give a capacity of 16,000 b/d. Plans are to pump gasoline and No. 1 and 2 fuel oils.

New 125,000-barrel tanker "Peerless" built in 1952 by British American Oil Co. Ltd. to supply its Clarkson, Ont. plant.



Pipe for the new line is to be manufactured by the Page-Hershey mills at Welland, Ont. It will be provided with cathodic protection against corrosion. Operation control will be by teletype. Radio will be used for communication with field cars.

A name has not yet been selected for the corporation which will be organized by Sun as its subsidiary.

In addition to the local terminal at North Toronto, Sun plans to erect a marine terminal on the lake at Toronto. Other bulk plants on the line will be installed at Sarnia, London and Hamilton. It will parallel the Imperial line built in 1951-52 most of the way.

First major products line to be built in Canada was by Imperial Oil Ltd. from its Sarnia refinery to Hamilton, Toronto and Ottawa. Construction was begun in 1951 and deliveries made as far as London before the close of that year. In 1952 it was extended to Toronto and the Ottawa branch constructed. Capacity is 39,000 b/d. The main line consists largely of 12-inch pipe. The Ottawa extension is 7-inch.

Second major products carrier is the Trans-Northern Pipe Line Company which was organized by British American Oil Co., McColl-Frontenac Oil Co. and Shell Oil Co. of Canada, with large refineries at Montreal and Clarkson, Ont. The Montreal plants process foreign crude, largely from Latin America. The 442-mile system was completed last November in time to be of service during the winter freeze-up.

Near Toronto the two product lines occupy the same right of way and pipe for both was laid at the same time and in the same ditch. A 42-inch ditch was dug and the two 10-inch lines laid simultaneously.

From Montreal to Toronto and Hamilton, a distance of 400 miles, the line is 10 inches in diameter; a 42-mile, 8-inch branch line runs from Farran's Point, near Cornwall, to Ottawa. Four main pumping stations are located at Montreal, Farran's Point, Kilburnie and Brighton. The pipe line has an initial capacity of 40,000 barrels daily. The addition of intermediate pumping stations can increase this capacity to about 75,000 barrels daily.

Nineteen refined petroleum products, including motor gasolines, diesel fuel, and stove and furnace oils, are transported through the line. The line can also be used for transportation of liquid petroleum gases.

Construction of Trans-Northern Pipe Line was carried out under the direction of A. N. Horne, president and general manager. Mr. Horne directed the building and early operation of the Trans-Arabian Pipe Line as one of his many previous pipe line assignments.

The most important feature of this products pipe line, and one which represents one of the greatest advances in pipe line engineering during the last decade, is precision pumping and continuous con-

(Please turn to page 163)

PETROLEUM CHEMICALS DIVISION

NEWS

May ★ One of a Series of Interest to the Petroleum Industry ★ 1953

What

are the advantages of buying gasoline additives from Du Pont?

1. **COMPLETE LINE**—Du Pont is the *only* supplier manufacturing a complete line of gasoline additives.
2. **EXPERIENCE** — Du Pont has had longer experience than any other U. S. company in making TEL (30 years). It has been making dyes for over 30 years; antioxidants 20 years and Metal Deactivator for 14 years.
3. **QUALITY** — Through the years Du Pont has set up quality control methods that are probably unsurpassed.
4. **TECHNICAL SERVICE** — To help refiners get the best results in the use of additives, Du Pont maintains *five* strategically located district laboratories.
5. **ECONOMY** — In many cases, the Du Pont district laboratories have been able to help refiners substantially reduce their cost of using additives.
6. **CONVENIENCE** — To assure fast, dependable deliveries, Du Pont maintains conveniently located warehouses, rail sidings and truck facilities throughout the country.

Petroleum Laboratory Has New Information On Deposit Formation

Until recently, there has been very little information on the reaction mechanisms which result in the accumulation of combustion chamber deposits—especially deposits formed by fuels containing tetraethyl lead.

Since nearly all modern automotive fuels contain tetraethyl lead, the Du Pont Petroleum Laboratory undertook a study of the sequence of chemical reactions which occur in engine deposit formation. The study is part of a continuing series of investigations on the mechanisms causing combustion chamber deposits.

Briefly, the study revealed the following:

1. The course of deposit forming chemical reactions is dependent on the temperature of the combustion chamber walls.
2. Gaseous lead oxide, produced from the decomposition of tetraethyl lead, does not undergo vapor state reactions—except when the gas layer near a clean combustion chamber surface is cool.
3. Solid lead oxide which condenses has a short life as a deposit constituent. It is attacked by acid gases to form simple lead salts or reacts with the simple lead salts in solid state reactions to form complex lead oxysalts.

How Loyal are Service Station Customers to Your Brand Name?

Report No. 2 in Du Pont's survey of consumer buying habits reveals interesting statistics on brand name recognition and loyalty to brand

As an oil company executive, facts about your customers and potential customers are vitally important to you. They are the basis for sound advertising, sales promotion and marketing plans. The Du Pont survey of consumer gasoline buying habits is designed to help give you the facts necessary to perfect such plans.

THE DATA presented in these two pages of Report No. 2 show that a big majority of customers recognize the gasoline sold at a station by the name on the big identification sign erected in front of the station.

The survey itself is based on many thousands of customer interviews and service station observations. As such, it is too voluminous for easy distribution. It is, therefore, being broken down into a series of easy-to-digest reports in booklet form. The first of these reports—issued in March of this year—covered service station selection and loyalty.

WHAT'S IN A NAME?

Report No. 2—"Brand Name Recognition and Loyalty to Brand"—is now ready for distribution to oil company marketing groups. It contains a comprehensive discussion of motorists' loyalty to certain brands and *reasons* for their loyalty.

The tremendous sales power of your brand name is borne out by the survey. For example, the number of motorists loyal to a preferred brand is *greater* than the number loyal to a "usual" service station. And the degree of loyalty in length of time and in quantities of gasoline purchased is also greater. What's more, two out of three people

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED **Survey Report**

say they buy a preferred brand *exclusively.*

These purchase habits are all documented and graphically illustrated in easy-to-follow form in Report No. 2 on the survey.

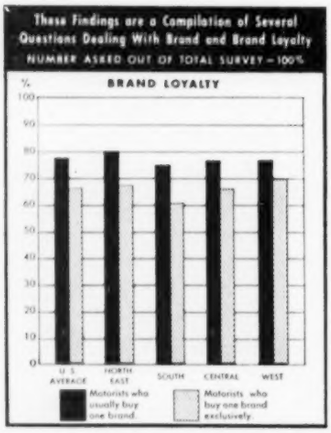
FACT OR BELIEF?

During the customer interviews, however, it was determined that many motorists base their choice of a gasoline brand—or prejudice against it—on *belief* rather than *fact.*

No product is purchased without the buyer's belief that it will satisfy his needs. Because of this, motorists are inclined to answer questions about gasoline brands in terms of brands that are *acceptable* to them.

On the other hand, people "believe," "think" or "have heard" that certain gasoline brands are of poor quality. In the survey 181 brand names and 3 brand groups received some mention as "a brand I would not buy."

A thorough study of replies showed that the reasons for acceptance are based almost entirely on quality *belief.* And the reasons for quality belief are nearly always connected with car performance. But service, friendship and station location were also mentioned frequently in addition to product quality as reasons for the motorists' purchase selection.



A TYPICAL CHART from survey Report No. 2. It shows that 77% of the motorists in the United States have a favorite brand and usually buy it . . . 66% buy one brand *exclusively.*

Central District Manager

EARL G. BENNETT, manager of the Du Pont Petroleum Chemicals Division central district, joined the Du Pont Company in 1931.

He was first assigned to the Grasselli Chemicals Department's Grasselli, New Jersey plant. He was later transferred to the Alcohol Division of the Organic Chemicals Department in Wilmington. There he did both technical work at the Jackson Laboratory and sales development work in connection with Du Pont's gasoline and lubricating oil additives.

In 1936, Mr. Bennett was assigned to special work with the Standard Oil Company of Indiana and The Pure Oil Company in Chicago on gasoline stability studies.

In 1939, he was transferred to Chicago in charge of sales in the western area for the Alcohol Division, which then included Du Pont's petroleum chemicals and dyestuff intermediates. He returned to Wilmington in 1943. In 1947, he was appointed Central District Manager, Petroleum Chemicals Division, in Chicago.

EARL G. BENNETT

He was graduated from Clarkson College of Technology in 1931 with a B.S. in chemical engineering. He is a member of the American Chemical Society, the Society of Automotive Engineers and the American Petroleum Institute.

BRAND NAME VS. GRADE NAME

An analysis of consumer buying habits also shows that there is little recognition by the motorist of gasoline "grade" names carried on service station pumps. In fact, motorists nearly always name gasolines according to the names carried on the big station brand identification signs. And the grade name is not a sales factor until after the decision to buy a certain brand is made.

The above are highlights of Report No. 2. More detailed information on grade choice will appear in Report No. 3, which is scheduled for publication sometime this summer.

Findings contained in these reports are based on 3,100 household interviews supplemented by 21,000 observations at 1,193 service stations.

National in scope, the survey is representative of gasoline buying patterns and trends throughout the country. We believe it is the most comprehensive market survey ever undertaken by any segment of the petroleum industry.

LITERATURE AVAILABLE

Here is a partial listing of the bulletins, reports, booklets and aids available to you through any Du Pont Petroleum Chemicals Division district office:

The Service Station and the Motorist — Report No. 1. An authoritative study of the four major gasoline marketing areas showing why motorists select certain service stations . . . and remain loyal to them Serial A-5396

Du Pont Fuel Oil Additive No. 2 — A 12-page bulletin describing this ashless stabilizer and dispersant that prevents clogging of fuel oil screens Serial A-5201

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A-5379

Printed in U. S. A.

Pipe Lines

(Continued from page 160)

trol from the despatching office. All products are metered into the system at Montreal East and are again metered out of the system at the various delivery terminals. This enables each owner company to receive at its own terminal exactly the same barrel of product that its refinery delivered into the line.

Positive displacement meters measure the amount of products pumped into and out of the line. Motor-operated valves on pumps and an automatic throttling valve maintain the prescribed rate of flow of products.

Montreal is a key station and all other stations synchronize their pressure and rate of flow with that established at Montreal. Pressure controls keep the line pressure within certain limits, approximately 1,000 lbs. A teletype system links the four pumping stations and ten meter stations. Resident operators man the pumping stations, and specially trained terminal operators control deliveries at terminals. Trans-Northern's despatching office handles shipments tendered by refineries of the three owner companies.

Terminals are located at Montreal, Ottawa, Cornwall, Prescott, Brockville, Kingston, Belleville, Port Hope, Toronto, Clarkson and Hamilton. From these terminals each company's own tank trucks will distribute the products to homes, industries and service stations in the area.

A modern communications network, installed by The Bell Telephone Company of Canada, controls the distribution of the products to the various terminals—utilizing telephone, teletype and special telephone wires to operate push-button control circuits.

Each station has a direct telephone line connected with the nearest large exchange. All stations also are linked by teletype so that orders for various products can be transmitted to the Montreal East refineries and advice received as to delivery time.

Exact timing is essential. When the Kingston center, for example, teletypes orders for quantities of different products, the dispatching center advises exactly when each will reach the Kingston station, which will then draw them off the main pipeline.

Three of the main stations—Montreal East, Prescott and Clarkson—have push-button controls to open and close valves and operate product-analyzing apparatus.

The control circuits will enable the dispatcher at Montreal East to feed quantities of various products into the pipe line simply by pushing buttons. Similarly, push buttons at the Prescott and Clarkson stations will operate valves to draw off required quantities of the various products.

Operating controls for the line are placed in separate buildings at each station. There are three principal elements in the system. (1) Hydron hydraulic valves for discharge control are of the type developed by Shell engineers. (2) Centrifugal pumps direct connected to electric motors are regulated by a Teledyne electronic system which automatically starts or stops pumping as hydraulic conditions dictate. (3) Mercoid controls shut down individual units when necessary to safeguard equipment.

All indicator and recording instruments are of the strain-gage type, eliminating the necessity of carrying part of the product into the control room. Instruments report suction and discharge pressures and differential pressure across the Hydron throttling valve. Visible and audible signals warn operators when conditions become abnormal. Signals indicate not only that trouble is developing but show where it may be located. Overheating in bearings or motor windings, pressure deviations in pump cases or seals, sump pump stoppage or leaks, all are indicated. An electronic gravitometer reports arrival of new batches.

Natural gas pipe lines built in Canada thus far are of a largely local character. One system of which part was built forty years ago serves Calgary. Another system serves Edmonton. During the past year Saskatchewan built its first important gas system. Saskatchewan Power Company completed a line from the Brock field last October to serve the towns of Brock and Kindersley. Plans are afoot to expand the system as quickly as possible to other cities and towns in the province.

Gas production in southern Ontario has been increasing in recent years. This gas is adequate on a long-term basis only for local consumption. Lines are in place to serve Sarnia, Hamilton, Windsor and adjacent communities.

Major pipe line projects now under consideration include a line to move Alberta gas westward to the Pacific Coast and south to Washington and Oregon in the United States. Two source areas are proposed. The second major line being considered would move western gas to eastern Canada and probably to Minneapolis and St. Paul, Minn. Complications are such that some delays may be expected in both cases.

For the past three years most pipe line companies organized in Canada have been incorporated under the 1949 federal pipe lines act. It is possible to incorporate under provincial laws, but the federal act permits acquisition of right-of-way by condemnation and gives certain other rights which are desirable.

A special act of Parliament is required under the 1949 act. First the proposed name must be cleared with the Secretary of State and the organizers must advertise their intentions throughout the Dominion.

A special bill to set up the company is introduced in the Senate where it must be read three times and be exposed to debate before going to the House of Commons for further consideration prior to passage to the Governor-General for his consent.

Pipe line companies incorporated by federal act in Canada are supervised by the Board of Transport Commissioners which also regulates railroads. The board must grant permits for line construction after proof is submitted that the line is necessary. When a permit has been granted, the company may make line surveys and later must submit its plans for approval. Plans must be registered in individual provinces crossed by the line. Specific approval is required for all highway, railway and utility crossings. River crossings also must be approved by the Department of Public Works. Permit to operate is given after the line is completed.

If oil or gas is to be exported it is necessary for the pipe line company to obtain special permission of the federal government and, in Alberta, of the provincial government as well. The Department of Trade and Commerce grants export permits. Materials for line construction are controlled by the Department of Commerce. The Department of National Revenue sets up regulations regarding depreciation for tax purposes and fixes import duties on materials and equipment. The Surveyor-General approves maps and drawings. Easements through public lands is obtained from various bodies such as Public Works, Natural Resources, Indian Affairs and the Department of Mines. The company must register in each province which it crosses.

A recital of the requirements to be met before a new pipe line can be laid is long and somewhat complex. In practice, however, it has been the experience of various companies that necessary clearances can be obtained quickly if there is need for the project.

New Canadian Offices for Schlumberger

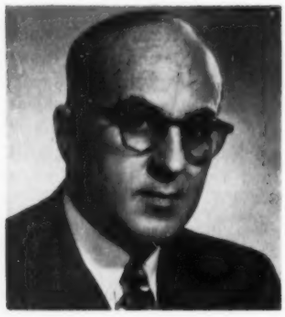
Establishment of two division offices of Schlumberger Well Surveying Corp. in Canada under the supervision of the Calgary headquarters has been announced by W. J. Gillingham, executive vice president.

Formation of the Western and Eastern divisions was made necessary by greatly expanded activity in Canada during the past year, Mr. Gillingham said. The program has also included the opening in recent months of district offices in Camrose, Alberta, and Kindersley and Virden, Saskatchewan.

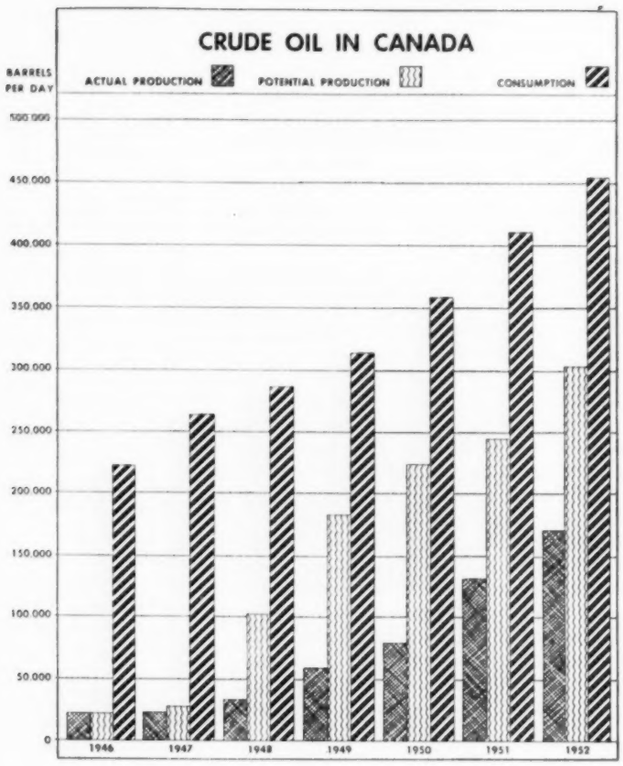
R. C. Davis, who has been serving as district manager at Edmonton, Alta., will head the new western division office. Mr. Davis, an employee of Schlumberger since 1937, served in the Texas and Mid-Continent areas before going to Canada in 1951.

D. M. Cowart will be manager of the eastern division with offices at Regina. Mr. Cowart was transferred to Canada from Shreveport, La.

Oil and the Canadian economy



W. F. Lougheed, economist of the Canadian Bank of Commerce since 1944, is an expert on governmental as well as business finance. He is the author of two books, one on labor - government - management relations and one on provincial finance. A native of Toronto, Mr. Lougheed received his education at the University of Toronto Schools, McMaster University and the University of Chicago. He was formerly an instructor at Wayne University, Detroit, research professor at Dalhousie University, and Professor of Commerce and head of the Faculty of Commerce at the University of Manitoba. Since joining the Canadian Bank of Commerce he has lectured at McMaster. Government has made use of his special knowledge in a number of instances. In Manitoba he aided the Wartime Prices and Trade Board and was advisor to the Provincial Government on industrial relations. In 1948 he was appointed Chairman of the Committee on Municipal-Provincial Relations of the Civic Advisory Council of Toronto and was responsible for the publication of the book entitled "Municipal Finance."



By W. F. Lougheed

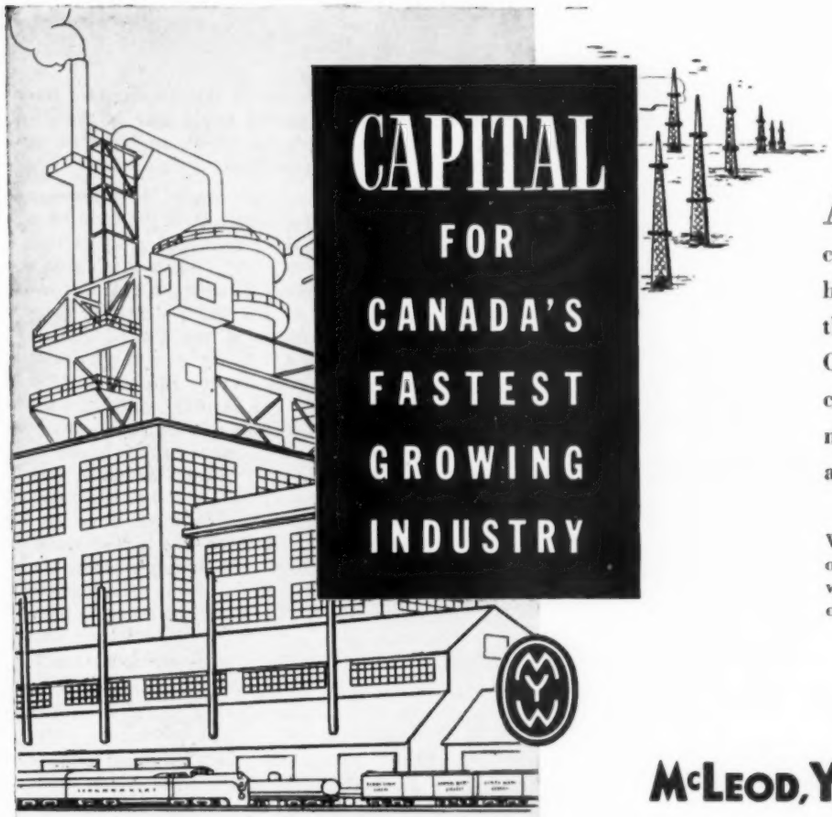
Economist, The Canadian Bank of Commerce

WHILE THE DISCOVERY of oil in quantity in Canada has excited the imagination of a great many people, its proximity, and the fact that discovery and development continues, makes difficult the task of objective assessment. It is attempted herein to outline in brief compass the economic background to which oil and its derivatives must be related, and to indicate wherein the impact of an expanding resource is most in evidence at the present time.

The persistence (and faith) of geologists and oil engineers in their constant search for oil deposits in Western Canada was rewarded in 1947 by the establishment of the Alberta field as one of the largest oil reservoirs in the world. Since then activity in this field has increased to major proportions. In addition, considerable exploration and development has taken place in some of the other western provinces. During these post-war years, oil development not only has played its part in stimulating a high level of economic activity in Canada, but it also is rapidly contributing to the expansion of national productivity.

Canadian economic growth and concomitant prosperity in the past six or seven years has been very closely related to the resurgence of resource development and to the large amount of investment which has accompanied it. The yardstick most frequently used to measure this growth, the gross national product, which represents roughly the value of the goods and services produced at market price, was estimated at 5.7 billion dollars in 1939. By the war's end productive output, measured in dollars, had doubled. Between 1946 and 1952 production steadily increased to 23 billion dollars. (These figures and those subsequently mentioned may present a slightly distorted picture due to the inflationary impact of recent years, but this situation is not confined to the Canadian economy.) The relatively large expenditures on consumer goods and services today, a natural reflection of gross national production, reflects the country's expanding standard of living. In 1952 consumer expenditures amounted to 14.3 billion dollars, an increase of 10.4 billion, or 267 percent over the 1939 expenditure. During this same period Canadian population increased approximately 25 percent.

To sustain a higher standard of living, an unusually large part of this rapidly growing national output has been devoted to new investment in Canadian business and industry. In 1939 new private and public investment amounted to approximately 765 million dollars. In 1952 investment activity reached 5,122 million dollars. This rapid growth is due in part to the need for increased production facilities to satisfy the expanded post-war market for consumer goods, but the major



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impetus has come from a large-scale program of resource development in which western oil is presently an influential segment. Of the 5,122 million dollars invested in 1952, 250 million dollars were absorbed by the Canadian oil industry. From the time of the Leduc discovery in 1947 to the end of 1952 the oil industry had invested 1¼ billion dollars in the search for and development of western crude reserves and in the provision of outlets for them. In terms of this total and of its current one-quarter of a billion dollars annual rate of expenditure on exploration and development alone, the development of Prairie crude resources ranks as by far the largest single project in Canada's program of resource development.

Natural resource development was the main dynamic behind Canada's growth for many years. However, it was to a great extent inhibited for the better part of a generation except for a few specialized instances, first by the depression and later by the war. With regard to size and balance of payments consequences, the most vital single venture in the recent rebirth of this development following the second world war is the development of the petroleum industry in the Prairie provinces.

For many years import requirements for crude oil and petroleum products have been one of the largest and most rapidly growing U. S. dollar items in Canada's foreign exchange balance. In 1947 Canada experienced a very heavy deficit in merchandise trade with the United States, with a resultant heavy loss of gold and foreign reserves, thereby emphasizing the importance of an earning asset at such a time. Following the Leduc discovery in that year, investment capital began to flow into Canada in sizable amounts, easing the heavy demand for American dollars. In 1951, despite Prairie crude production which had expanded to nearly one-third of Canada's total requirement, the external bill for petroleum amounted to more than $350 million. In 1952 the total value of imports of crude petroleum and petroleum products decreased to $342 million. The value of crude imports from the United States rose steadily from $46 million in 1945 to $90 million in 1948. From 1948 to October 1952 these imports declined to $46 million. Petroleum product imports from the United States followed a somewhat similar pattern from 1945 to 1948, increasing from $21 million to $95 million, then declining in 1949 to $77 million and steadily increasing through October 1952 to $85 million. The fluctuations in these imports of crude petroleum and petroleum products from the United States follow quite closely the pattern of the total import picture for Canada of these products. From 1945 to 1948 the value of total crude imports rose $120 million to $192 million in 1948, declined slightly in 1949, increased steadily through 1951 to $231 million, and dropped to $207 million in 1952. Total petroleum products imports increased from $22 million in 1945 to $109 million in 1948, dropped to $84 million in 1949, and rose rapidly thereafter to $135 million in 1952. It has been predicted that within a few years Prairie oil supplies will be sufficient for all of Canada west of Montreal and for exports to balance the requirements of the Montreal area and the Maritimes.

Unlike other resource developments, for example pulp, home discoveries of oil replace a considerable share of imports, thereby assuring the saving of foreign exchange. In the case of pulp, Canada depends to a great extent on markets abroad which entail uncertainties common to competitive markets. Our approach to self-sufficiency in oil and the influx of investment capital for oil development are regarded as important factors in strengthening the Canadian dollar exchange. From 1946 to 1951 it is estimated that capital inflow for petroleum investment was nearly 35 percent of the net capital movement from the United States to Canada. Since 1948 every succeeding year has

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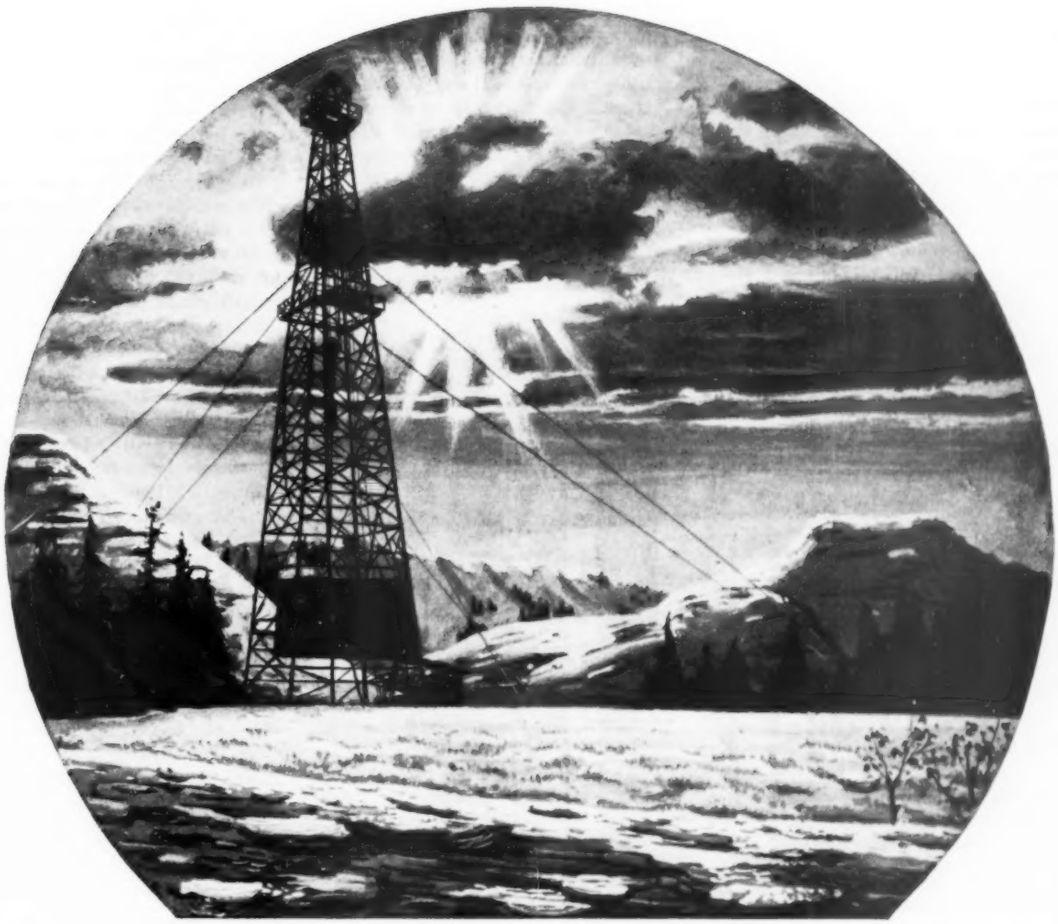

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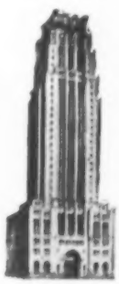

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brought marked savings of United States dollars through the displacement of imported crude oil. In 1952 these savings amounted to $180 million (U.S.) as contrasted to $90 million in 1949 and $9 million in 1948.

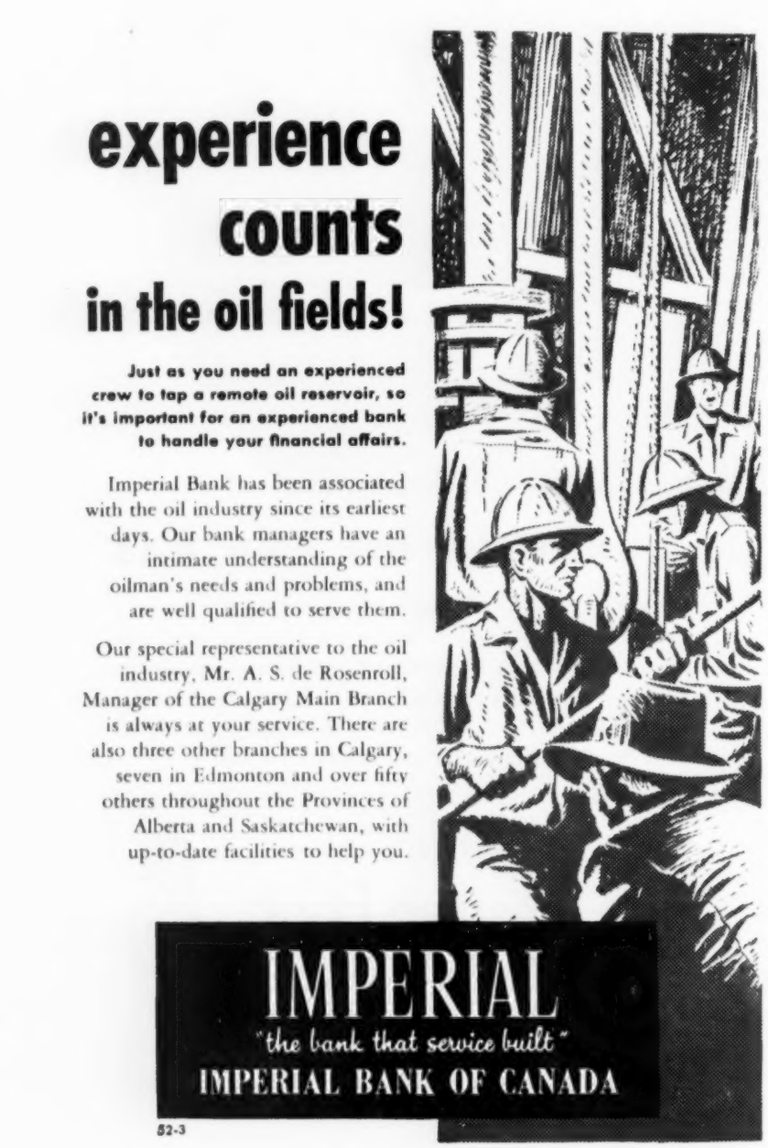
Western Canada is, potentially, one of the world's major gas and oil producing areas. Already, oil production, which has been prorated to less than 60 percent of the industry's potential, is nearly forty percent of Canada's requirements, compared with less than 10 percent of much smaller needs a few years ago. From some 21,000 barrels a day, Prairie output is now averaging 170,000. This trend is most noticeably reflected in Figure 1. Oil reserves have increased 23 times from 1946 to 1952. As a result of this rapid increase in activity in Western Canada, it has been estimated that one-half of the country's needs in oil could be satisfied if additional facilities were available. As activity increased there has been a steady rise in the discovery rate, with oil and gas discoveries during 1952 at the rate of two per week as compared to seventeen all told during the year 1947. Output has risen eightfold in the years 1946 to 1952. Domestic production satisfied 37 percent of the greatly enlarged demand for oil in Canada during 1952; before the Leduc discovery nine percent of this country's requirements were being met by domestic production.

Reflecting the nation's standard of living, Canadians rank second in the world in use of petroleum products per person. In 1952, domestic demand for petroleum products averaged 455,200 barrels per day or 12 barrels per person, as compared with 410,700 barrels per day in 1951 and 357,900 barrels per day in 1950. Increase for the year 1952 was about eleven percent. During the past seven years the demand for petroleum products has increased 100 percent and it is reasonable to expect that in the future the nation's needs will approach or possibly pass 750,000 barrels daily. Despite the rapid increase in demand, crude production figures previously mentioned indicate the great strides Canada has made toward being self-sufficient in petroleum products since the Leduc discovery in 1947. Crude self-sufficiency was increased from 8.1 percent in 1947 to 37 percent in 1952.

The present high per capita consumption of petroleum products has arisen out of the fast-growing uses for such products. The use of oil itself has risen 85 percent since 1946 as contrasted to a 43 percent increase in the United States during the same period. The demand for heating oil has shown the sharpest increase, with one Canadian home in four now being heated by oil. Automobiles, tractors and farm combines also have rapidly increased in number, motor vehicles in 1951 being twice as numerous as in 1939. Canadians in 1939 used half as much oil per person as Americans, but in 1952 used $\frac{2}{3}$ as much—11.5 barrels to 17.4 barrels in United States. Canada rates another second in consideration of the world use of energy. One-quarter of the mechanical energy used in this country comes from oil, a proportion very similar to the United States.

Transformation of the crude reserves into motor fuel, heating oil and other products for consumers has stimulated intense activity in a whole range of products including the building of pipe-lines to facilitate distribution, construction of storage facilities, increase in refinery capacity, and the development of a petrochemical industry. Need for these facilities was especially marked in Canada, where the location of the new crude brought a reversal of the former east to west flow of petroleum. Three of Canada's four regions now draw on Prairie crude supplies.

The Prairies served as the first market for western crude, their entire demand being met by mid-1949. The first new Prairie refinery was erected at Edmonton in 1948 with two additional ones being completed there in 1951 and one completed at Winnipeg. Domestic crude received at Prairie refineries increased from 18,528 barrels per day in 1947 to an estimated 107,200 barrels per day in 1952.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The first western crude reached Ontario refineries in 1951 following completion of the Interprovincial pipe line at a cost of $90 million from Edmonton to Lake Superior, and of two large tankers, docks and storage facilities. The capacity of this pipe line, initially 40,000 barrels per day, is to be increased to about 100,000 barrels per day by 1954. British Columbia began to refine Prairie crude the latter part of 1952. Refinery expansion is now under way in this province in anticipation of the completon of the Trans Mountain pipe line which will follow a 685 mile all-Canadian route from Edmonton to Vancouver and also will supply crude to the Pacific Northwest states. The pipe line will form the final link in a complete trans-Canada oil transportation system. Its initial maximum capacity of 75,000 barrels per day is expected to reach 200,000 barrels per day with additional pumping stations. Besides these new crude oil pipe lines, two products pipe lines now operate in eastern Canada. During the years 1939 to 1952 refining capacity doubled from 200,020 barrels per day to 411,850 barrels per day. Further expansion currently under way will raise Canada's over-all refining capacity to about 480,000 barrels daily. Pipe line expansion in both crude and product lines has been rapid since 1948 when their mileage was estimated at 455. At the end of 1952 their mileage was 2,448, with an anticipated 3,149 miles at the end of 1953.

With this rapid growth in all phases of the Canadian oil industry, large investments have been made. From 1946-51 inclusive, $750 million was invested in Western Canada—$575 million for crude exploration and development, $115 million for transportation facilities, and $60 million for refineries. During this same period $250 million was invested in the other areas of Canada. Forecasts indicate that an average yearly investment of between $250 and $400 million may be required to expand all phases of the oil industry as compared with an average of around $170 million in the first six postwar years.

Compared with the impressive increase in investment which in 1952 was four times what it was in 1945, the growth in permanent employment in this industry has been relatively small. Since 1948 about 2,000 permanent new jobs have been created in the petroleum products industry as a result of the construction and expansion of oil refineries. Large refineries and processing plants employ comparatively few workers, and in recent years, for instance, labor costs in the refining industry have averaged only about six percent of the value of production. However, in this period of expansion the industry is providing considerable temporary employment. The construction of new refinery facilities and the pipe lines now under way are providing jobs for several thousand workers. Employment is

Canada's Oil Resources Continue to Expand

In the past six years the Canadian Oil Industry has grown at a rate perhaps unequalled by any other country in the history of the oil industry. Proven reserves have increased faster than the rate of production and now stand at about 1,750,000,000 barrels of oil and over 10 trillion cubic feet of gas.

There is a great oil pipe line now building to the Pacific coast and an extension and enlargement of the trunk pipe line to the east. Plans are already laid for large trunk gas lines, many hundreds of miles in length and costing hundreds of millions of dollars. These are all positive evidence of the faith of major operators in the certainty of further great increases in reserves and output.

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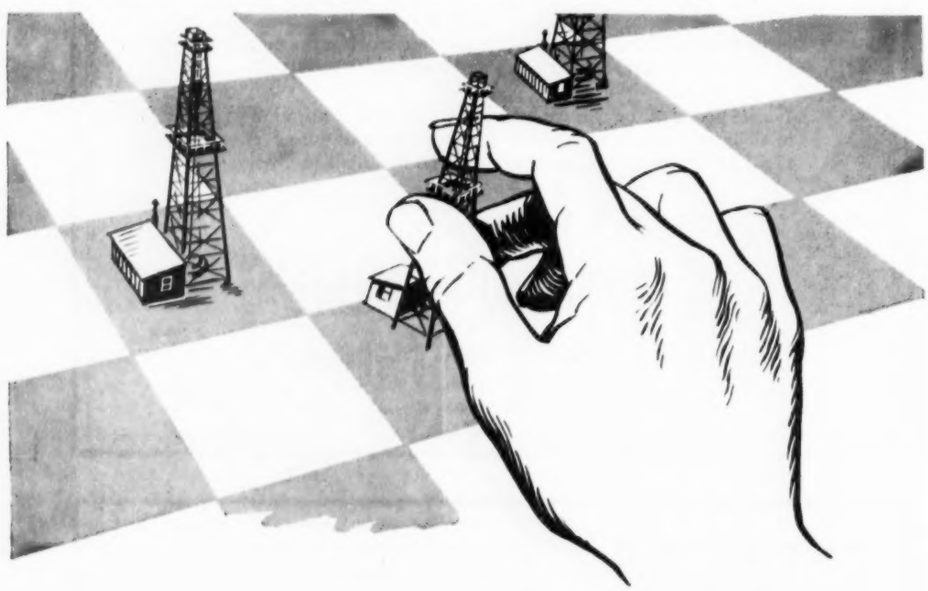
of course also affected in industries supplying equipment for these construction projects. The total number of employees in the petroleum products industry rose from about 9,300 in June 1948 to about 12,000 in June 1952. During the same period the increase was more marked in employment in the production of oil and natural gas, from 5,000 to 11,000, but this increase includes employment in exploration and well-drilling and does not therefore represent a large proportion of permanent jobs. At this time it is difficult to say what effects petroleum development will have on employment in the future, but it is reasonable to expect a continued growth of industries, such as the petrochemical industries which produce plastics, synthetic rubber, solvents and other commodities which use petroleum products as their raw material or as fuel.

Of growing importance to the progress of the economy is the petrochemical industry which is being developed on a large scale along with the expansion of natural gas, crude production and refining capacity. A major part of Canada's present petrochemical expansion is underway in the central region where large refining centers supply raw materials at a somewhat greater cost than in the Prairies, but much closer to the ultimate market. Certain chemical and other industrial developments gravitating to Alberta will be limited to those for which an abundant and cheap supply of raw material is of substantially more importance than transportation costs of the finished product. The many by-products from large-scale gas production assure western Canada of a petrochemical industry of national importance. In the United States the petroleum industry is depended upon for one-quarter of the nation's chemical output and it is anticipated that this proportion will approach 50 percent within the next decade. The two chemical plants which were recently built in the Edmonton area at a cost of $60 million may be only the beginning of a multi-million dollar industry.

Discoveries of natural gas in Western Canada in association with the oil development introduced an industry which will supply a major portion of the raw materials to be used in the petrochemical industry. Large markets are at present vying for this gas on the Pacific west coast and to the east in Winnipeg, the Minneapolis area, Toronto and Montreal, but decisions as regards the pipe lines to be built and the export markets to be recognized have yet to be announced by the federal government. Gas reserves in Alberta have increased from 4.7 trillion cubic feet at the end of 1950 to 6.8 trillion cubic feet within a year. Recent discoveries in northeastern British Columbia and Saskatchewan probably raise the total reserves to 10.5 trillion cubic feet. It was recently announced by the federal government that eastern Canada's natural gas requirements must be satisfied before any other export permits are granted. It is conceivable that Canada will have a gas-producing industry comparable in size and activity to that forecast for oil in the not too distant future.

In looking to the future, further markets will have to be developed if there is to be a continued growth in Western Canada's oil production. In the eastern provinces demand still exceeds the supply of Canadian crude; the central United States remain a large potential marketing area; it is expected that the crude demand in British Columbia and the western United States will gradually increase. However large these potential markets appear to be, Western Canada is still confronted with the major problem of transporting its crude and keeping its prices at a competitive level with the crude marketed in Canada from other sources.

Further expansion in the oil industry is foreseen, with production in Western Canada possibly exceeding 300,000 barrels daily. It is expected that exploration and other operations in the industry will continue at their present high rate. It



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is anticipated that the 1953 markets will absorb approximately 320,000 barrels of western crude daily. Only 10 percent of the petroliferous area of Western Canada has been examined. With nearly two billion barrels of reserves already established, it may be possible to produce more than the 7½ percent of reserves now produced annually without a serious drain upon the existing reserves. There appears to be little doubt that reserves will be able to keep pace with demand considering the present high rate of exploration and development. Present activity in the oil fields suggests that over the next four years a further billion dollars will be spent in the search for additional crude reserves.

Canadian Wildcats

(Continued from page 116)

discoveries was six times as large as in 1950.

Total drilling activity in Western Canada continued to rise in 1952 in about the same ratio as wildcatting. Some 240 rotary rigs were busy in the west during the year to complete 2,253 wells. Of these, 1,409 were field development wells, 715 wildcats and 129 designed to extend previously discovered fields. There were about 4,000 wells capable of production in Western Canada on December 31, compared with 2,712 at the end of 1951 and 1,936 at the end of 1950.

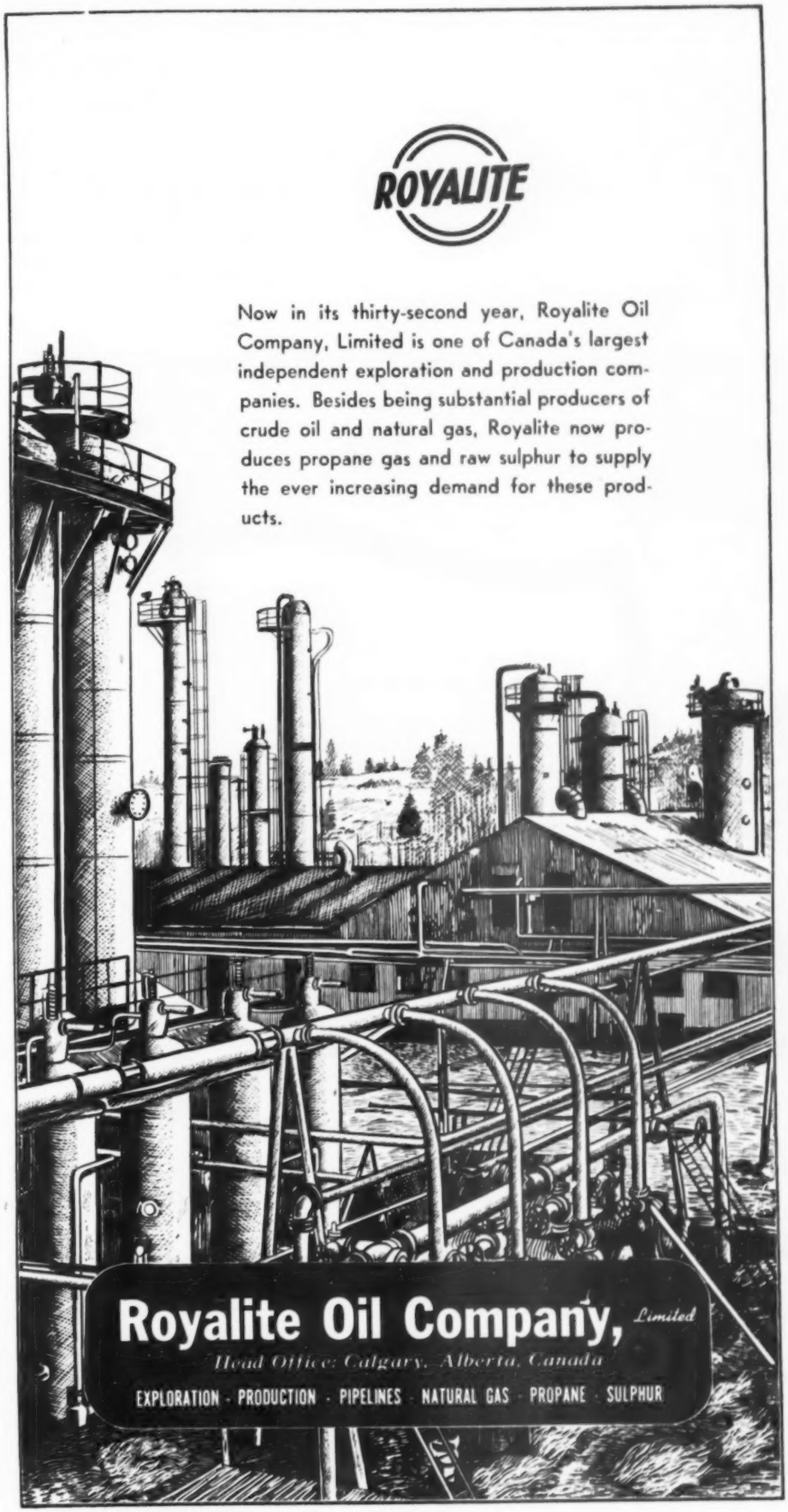
In Eastern Canada virtually all activity was in Ontario. One wildcat was drilled in Nova Scotia and one in Newfoundland. Both were dry. In Ontario 354 wells were completed of which 86 were exploratory. Considerable drilling for gas is in progress in this province. Recently the Ontario gas fields have been increasing their known reserves.

In Canada as a whole, 2,609 wells were drilled in 1952 compared with 1,590 in 1951. For the current year it is estimated that this 1952 figure will be exceeded.

In 1951 the Canadian industry drilled 1,260 wells for oil and 320 for gas. Of the wells drilled for oil, 935 or 74 percent were successful and 164 were dry. Of the 320 wells drilled for gas, 192 or 60 percent were producers and 128 were dry. There were 4,343 producing oil wells and 3,963 producing gas wells at the end of the year.

In 1950 wells drilled for oil totaled 968 of which 812 were productive and 156 dry. The industry drilled 343 wells for gas, of which 244 were producers and 99 dry. Most of the drilling for gas has been in southern Ontario for adjacent markets. There were 3,713 gas wells in that province at the end of 1952 out of a total of 3,963 in the Dominion.

Completion late this year of pipeline facilities from the west will permit the production of oil at a rate higher than the present 300,000 b/d potential, thus assuring producers of an outlet for new oil which may be discovered in the course of further exploration.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Imports Question Discussed

The campaign to limit imports of oil into the United States has been renewed with increased vigor in recent months. The flattening of the domestic demand curve and the rising tendency of inshipments have been the principal arguments put forward in support of further restrictions. Coal producers have taken a leading part in the fight to limit receipts of foreign-produced oil which heretofore has been carried on mainly by groups of independent domestic oil producers. The coal men have been stirred to activity by the displacement of their product along the Atlantic Coast by residual fuel oil from South America. At the moment, heavy fuel is said to be about 59 cents per barrel below parity with coal.

Increases in stocks of both crude and refined products in recent months have caused the Texas Railroad Commission to cut back allowables. For the past two years Texas crude production has averaged about 2,800,000 b/d. At the end of 1952 the output was just over three million barrels daily. Currently the production is off about 100,000 b/d and the Railroad Commission is ordering further cuts.

Prior to its last meeting, the Railroad Commission asked oil importers what their program is for the year 1953 as a guide in arriving at domestic crude requirements. Publicity was given to replies to the questionnaire.

Early in February the executive committee of the American Petroleum Institute met to consider API policy on imports. The committee at that time approved the report of the Institute's National Oil Policy Committee as follows: ". . . that the statement in the National Oil Policy for the United States adopted by the National Petroleum Council in 1949, relating to foreign oil and imports, be endorsed, and that members of the industry dedicate themselves to the observance of the principles therein stated."

The policy recommended by the National Petroleum Council was that exploration and development efforts of the domestic industry should be encouraged and that imports should be on a flexible basis to supplement a healthy domestic industry operating on sound conservation policies. It was stated that imports in excess of national needs, after taking into account domestic production in conformance with good conservation practices and within the limits of maximum efficient rates of production, will retard domestic exploration and development of new oil fields and the technological progress in all branches of the industry which is essential to the nation's economic welfare and security.

At the API meeting Hines H. Baker of Humble Oil & Refining Co. stated that the industry now has built up a reserve producing capacity of about one million barrels daily which is generally recognized as desirable. Maston Nixon, chairman of the Import Policy Committee of the Independent Petroleum Association of America, told the API that drilling in the United States is tending lower and that economic factors are seriously impeding the industry's ability to maintain a proper reserve capacity

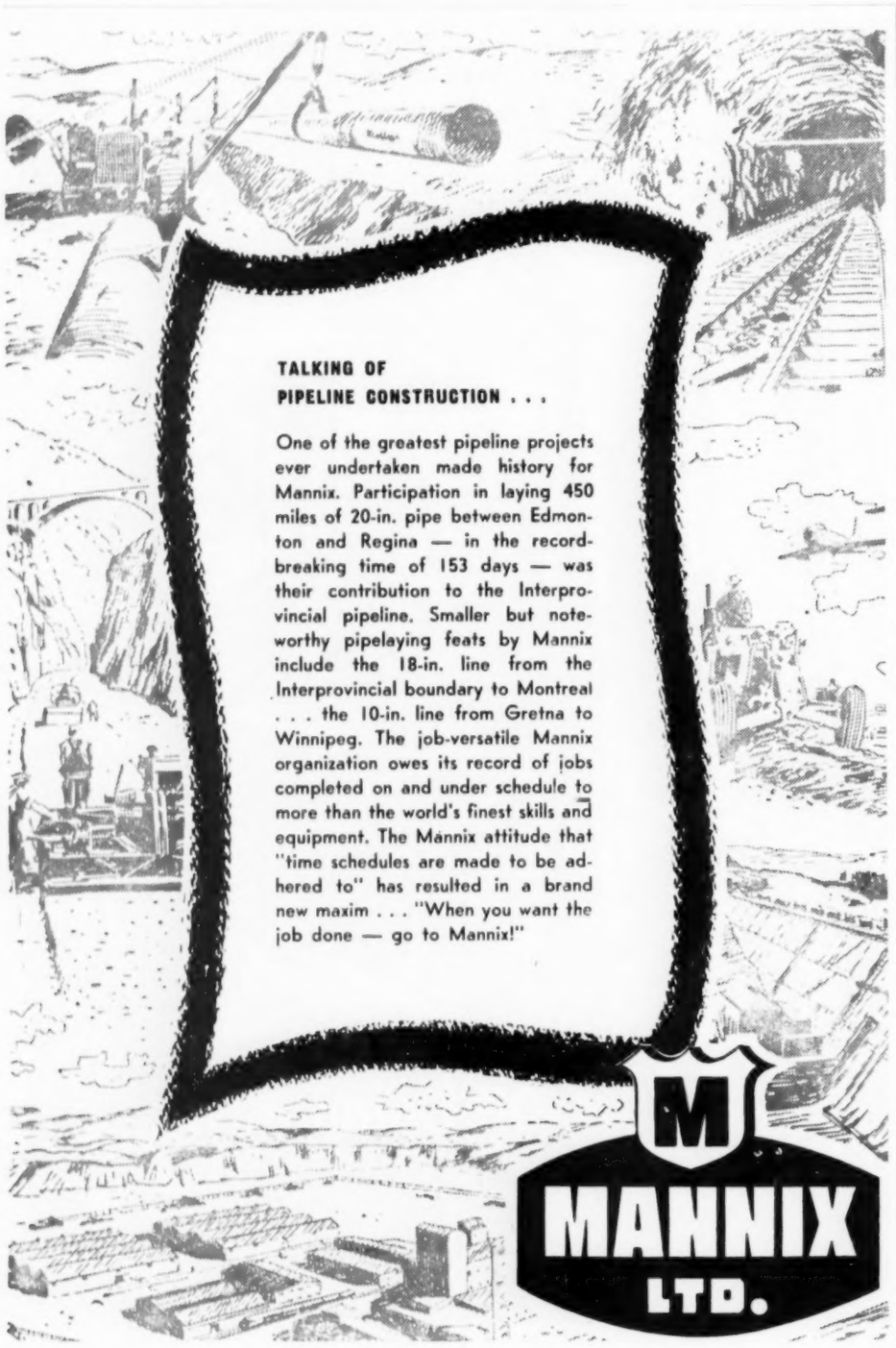
Currently the IPAA committee has been called to meet for the consideration of methods which can be applied to restrict imports. The committee will debate the quota system as against higher import duties or voluntary restrictions undertaken by principal foreign operators. At a luncheon of the New York IPAA district on March 6, John M. Lovejoy, IPAA vice president for the area, said that he thinks voluntary action by individual companies is the answer.

Charlton Lyons, association president, said that the organization does not oppose imports. Its policy is to insist that foreign oil supplement and not supplant domestic production. With a billion acres of unexplored potential oil land in the United States, he said, domestic demand can be met beyond question by American producers if the crude oil price is adequate.

Russell Brown, IPAA general counsel, told a group of newsmen that the association thinks that current imports should be reduced about 300,000 b/d.

Most of the advocates of import restriction have supported plans for a rise in oil tariffs or the adoption of a quota system that would hold the quantity of foreign oil to be admitted to five percent or some similar fraction of domestic production.

A third proposal suggested in Washington is for Congressional action permitting oil importers to agree among themselves to cut back oil imports. A variation of this is for the Secretary of the Interior to tell each company how much oil it can bring in month by month. Sponsors of this plan argue that it would give an exemption from the antitrust laws, on the one hand, and give importing companies an argument as they face pressure from abroad to produce and sell ever more petroleum.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Egloff Given Washington Award

Dr. Gustav Egloff, director of research for Universal Oil Products Co., was presented with engineering's foremost honor, The Washington Award for 1953, at a dinner February 23. The presentation was made by Ovid W. Esbach, president of the Western Society of Engineers and dean of the Technological Institute of Northwestern University, "for distinguished leadership in petroleum research and development in professional activities and in community services."

In receiving the Washington Award, Dr. Egloff joins an imposing list of world-famous personages who have been so honored. These include Herbert Hoover, 1919; Orville Wright, 1927; Charles Kettering, 1936; Ralph Budd, 1941; Henry Ford, 1944; Arthur Compton, 1945; Vannevar Bush, 1946; Karl Compton, 1947; Wilfred Sykes, 1950; and Dr. Henry Heald, 1952.

The award is based on recommendation of a commission representing the American Society of Civil Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and the Western Society of Engineers.

Oil Development Stirs British Columbia

Government figures released at the end of January show that British Columbia had its biggest land rush in history in 1952. Permits numbering 301 were issued up to the end of the year by the petroleum and natural gas division in Victoria. They covered 13,833,336 acres, more than 3 million acres above the 1951 permit acreage.

The rush, which was sparked by the British Columbia oil discovery at Fort St. John in November 1951 by Pacific Petroleums, has brought the area of land under permit to 34,577,616 acres with 564 permits granted. Government officials feel that most of the desirable acreage has been taken up.

Oil and gas exploration activity in the province has increased from 2,337,940 acres under 22 permits in 1949 to 20 million in 1951 with 263 permits. In addition to the permits held at the end of 1952, there are eight applications pending for 212,939 acres.

There are 139 drilling licenses covering 1,403,117 acres and 10 leases covering 6,400 acres in effect. Total area under gas and oil permit, license and lease is now 36,206,237 acres. Greatest activity has been centered in the Peace River area where 32,824,431 acres are taken out. Next is Quesnel area with 961,758 acres; Fort Fraser with 695,722 acres; Lillooet, 507,444 acres; Prince George, 437,840 acres; and Fernie, 307 acres. Vancouver Island has 58,688 acres under lease, permit, license or application while New Westminster has 188,096 acres and Vancouver 9,862 acres.

Newcomer to the exploration picture is General American Oil Co. of Texas, which will manage and finance exploration of one million acres in the Peace River area under an agreement with Fargo Oils.

The lower mainland area, practically undisturbed by the flurry of oil exploration in the northern sections of the province, is the scene of rapid expansion as additional refinery capacity, pipe lines, docks and tank farms are being rushed to be ready for the completion of the Trans Mountain oil pipe line from Edmonton in August.

Preliminary work has already been completed on refinery additions by Imperial Oil at Ioco and Shell Oil at Shellburn. Tractors have cleared the site on Burnaby Mountain for the tank farm at the pipe line's Vancouver end and lines are being readied to serve the Vancouver refineries from the tank farm.

In the interior of British Columbia, towns along the projected route of the Westcoast Transmission Company's natural gas line from the Fort St. John fields are already bidding for a supply of gas. Application of the West Coast company is now before the Federal Power Commission in Washington.

Inland Natural Gas Co., Ltd., the company that will set up the distribution system if the Westcoast line is built, received "letters of intent" from towns and municipalities along the line's proposed route. Full plans of the company await the FPC decision on Westcoast's application to pipe gas into the Northwest states. Inland is already selling natural gas at Dawson Creek via a short pipe line from Pouce Coupe. John McMahon of Vancouver, Inland vice president, says this line is making money after two years of operation.

Westcoast, however, is not without opposition in its bid to pipe gas to the Pacific Northwest. This opposition comes chiefly from the Pacific Northwest Pipeline Corp., which seeks permission to build a $160 million line from New Mexico to Bellingham, Wash.

Alberta crude, which will be piped to the Pacific Coast for the first time when Trans Mountain completes its pipe line this fall, is expected to be used for a new refinery which Pacific Oil and Refining Co. has announced it will build near Tacoma with completion scheduled for September 1954.

Cost of the new refinery has been stated as $5,667,500. Charles Alberding, president of the refinery firm, said in Chicago that his company would refine Alberta crude brought from Canada either by pipe line or barge. If the line, which will cross into Washington to serve the $35 million General Petroleum refinery to be built at Ferndale, Wash., does not go as far south as Puget Sound, the oil will be barged to Tacoma. Mr. Alberding heads the Superior Refining Co. which refines Alberta Oil at Superior, Wis.

Diesel and Power Unit Brochure

Six International diesel engines and power units ranging from 45 to 180 horsepower are described in a new two-color mailing folder recently issued by the International Harvester Export Co. Described are such prominent features as compression ignition, precision injection, controlled combustion and efficient 4-cycle design. Designated as E-96-B, the folder is available in English from distributors of International industrial power equipment located throughout the world.

Book Review

Petroleum Production Engineering: Oil Field Exploitation, by Lester Charles Uren, Third Edition; published 1953 by McGraw-Hill Book Co.; New York; 807 pages; $10.00.

This book is the third edition of Prof. Uren's well known work on oil field exploitation. In its new form the book closely parallels the author's course in petroleum production methods at the University of California. It is planned to provide the descriptive background of such a course and to give the student of petroleum engineering a proper perspective of the petroleum-producing industry and an understanding of its terminology, equipment and methods, and at the same time to give executives, investors and technologists an insight into these same matters. That he has succeeded in both these directions is evident from a survey of the rich contents of the book (there are more than 360 illustrations, di-

Financing Canada's Oil Development

New oil discoveries and increased production of Canadian crude oil indicate that a leading role will be played by this important industry in the growing economy of the country. Oil and gas companies desiring to become established in Western Canada, those planning further expansion, or requiring additional working capital are invited to discuss with us, without cost or obligation, ways and means of obtaining funds for their particular needs.

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Caltex Indian Refinery

California Texas Oil Company, Ltd., has adopted definite plans for a refinery in India to meet increasing requirements there for Caltex petroleum products. Construction is expected to begin in 1955, the plant to be located in Vishakapatnam on the east coast of India. Capacity as now planned will be 10,000 b/d. Of the capital shares of the new refining operation, 25 percent will be made available to nationals of India.

To Open Edmonton Warehouse

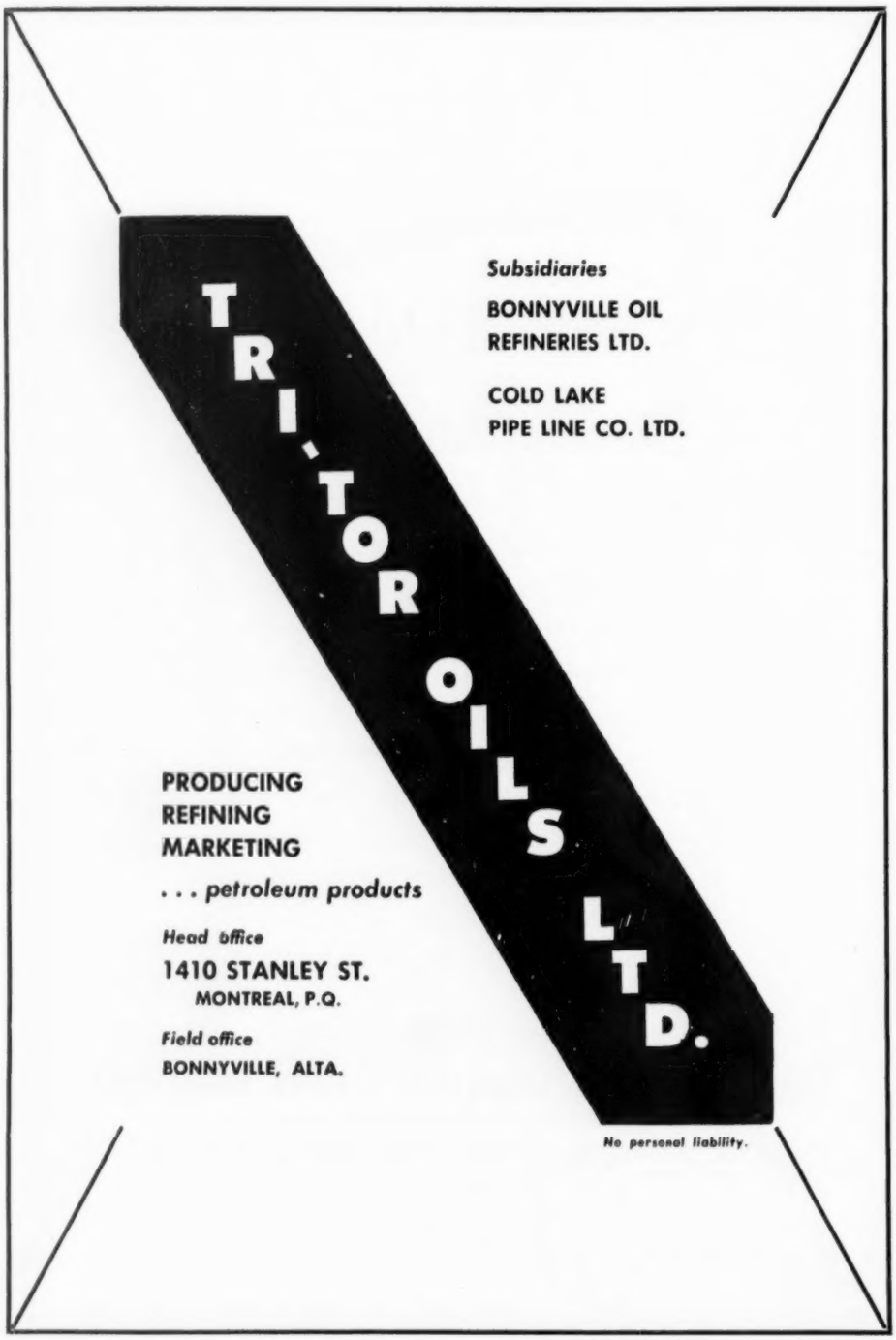
Clarence Sublett, vice president of Franklin Pipe & Supply Ltd., Edmonton, Alberta, announces a new office and warehouse at 9931 67th Avenue, Edmonton, to be opened in May. A complete warehouse stock of refining and oil field equipment will be maintained.

Fact Book On Williston

An Introduction to the Williston Basin; 173 pages, plus maps, charts and tables. Published by Petroleum Information, Denver, Colorado, and Casper, Wyoming. Price $10.

This is a book which will prove of great interest to oil men. Williston is still a magic name because of the extent of the field, its international character and the rapid succession of developments that have followed the bringing in of the discovery well in 1951.

The present work presents a full summary of these developments, including chapters on the progress of geological information regarding this area, descriptions of the various fields, a history of oil leasing, discoveries, the growth of production and plans for transportation and processing. Maps and tables of leaseholdings, wells drilled, and logging records provide valuable technical information.



Bank Offers Bulletin Service

The oil and gas department of the Royal Bank of Canada introduced a special bulletin service for the oil and gas industry recently. This service provides, in a convenient, practical form, current information on a number of important aspects of the industry in Canada. Each bulletin covers one specific aspect of the subject. Among the topics dealt with are: conservation and proration, royalty payments, oil financing, lease regulations, and provincial regulations. Bulletins are kept up to date in order to make the most current information readily available. The service permits each bulletin to be revised quickly and reprinted whenever occasion demands. The bank supplies the bulletins in a convenient file folder, and does not charge for the service.

Recently the Royal Bank published a 20-page illustrated booklet, entitled "Serving Canada's Oil and Gas Industry," which describes in some detail the services it offers to oil and gas men. The bank's role in financing, the oil and gas department, the special bulletin service, and other services of value to the industry are some of the subjects covered. It also contains a large-scale map of Canada's oil and gas fields, showing active areas, areas under exploration, existing and proposed pipelines, and locations of the bank's branches throughout Western Canada.

British Subsidiary in Canada

Clyde Tube Forgings of Canada Ltd. was incorporated in June 1952, and went into operation in November of that year. This new company is a subsidiary of Clyde Tube Forgings Ltd. of Glasgow, which is associated with the pipework engineering firm, Shaw-Petrie Ltd. of Glasgow. These two Glasgow companies have been responsible for the supply of seamless butt welding fittings, of all types and sizes to American Standards, and the fabrication of a large amount of pipework, pre-fabricated and on site, for the petroleum industry both in Great Britain and overseas.

Clyde Tube Forgings Ltd. made its entry into the dollar market three years ago by securing a million dollar contract from the United States for butt welding fittings. This has been followed recently by a further contract amounting to half a million dollars. In order to develop and extend this work, the new Canadian company has built offices and works at North York, near Toronto. The plant has been in production for some time with key workers brought from Glasgow to instruct local employees in the required techniques. The company also handles shop prefabricated piping and site construction to code requirements.

Canadian Base Maps

The Muldrow Aerial Surveys Corp. is constructing regional base maps of the prospective oil area of western Canada, involving approximately a quarter of a million square miles of controlled mapping, according to Ellison Muldrow, president of the mapping firm. This is believed to be one of the largest map construction projects for controlled regional base mapping ever carried on in the oil industry for Canadian coverage.

Basic information is now being compiled through the Department of Natural Resources, Survey Branch, Department of Lands and Forests, and Department of Technical Surveys. All are branches of provinces of the Dominion of Canada. Stanolind Oil and Gas Company has contracted to buy this coverage.

Sales Record

Sales in the first quarter of 1953 set a new record in the 45-year history of Canadian Oil Companies Ltd., W. Harold Rea, president, reported to shareholders at the annual meeting. Sales to date this year are more than 25 percent higher in volume than in the first three months of 1952.

Flexibox Mechanical Seals

During 1952, the Flexibox mechanical seal Type RR C.P.Q. has been put into operation in many refineries and petroleum-chemicals plants on pumps handling propane and other light hydrocarbons under high pressure.

As a result of development work over three years, a special type of seal has been produced for use in the rotary fuel pumps for jet and piston-engined aircraft where revolutions may be as high as 20,000 rpm. These seals have received official recognition in the form of approval of inspection facilities by the Aeronautical Inspection Directorate, a department of the British Ministry of Supply.

Return of Premium Motor Fuel

Effect of the reintroduction of premium grades of motor fuel, authorized by the British government from February 1, remains a subject of discussion among the trade and also among consumers.

All the distributing organizations have announced that premium grade fuels will be available at their filling stations and the majority have established a price for these higher grades —three pence per gallon above the rate charged for the pool spirit which for years has been the only kind obtainable. Some companies have listed two premium grades, one at four pence per gallon above the pool spirit level and the second at an increase of two pence. In addition, some of the companies are also re-introducing a benzol-petrol mixture.

Apart from the benzol mixtures, it can be assumed, from information supplied verbally, that the octane rating of the "premium grades" will be of the order of 80. While an extensive advertising campaign has been undertaken to promote the use of these premium grades, it is still too early to judge its effect.

With the present retail prices of pool spirit ranging from 4s. 2¾d. inner zone to a maximum of 4s. 4¼d. in the outer zones, the government tax of 2s. 6d. leaves an actual price margin of 1s. 8¾d. to 1s. 10¼d. to cover all production, manufacturing, advertising, distribution and sales costs. There has been talk of severe competition or even a price war, but it does not appear that there is much room for a price reduction from prevailing rates and if there is a really intensive sales competition, it probably will be based on quality, which is a very elusive property, or on service at the filling stations.

A factor affecting the immediate demand for high test motor fuel is the age of the majority of cars in use on British highways. For a long time past it has been virtually impossible for British motorists to obtain new cars and applicants have been told that their requests could not even be considered for two or three years, depending on the state of the order books of the manufacturers. At the same time the policy of the government has been to discourage domestic buying in favor of export and this was one reason adduced for imposition of the heavy purchase tax of 66⅔ percent and of various other restrictions.

As a consequence, many of the cars now in use are far beyond the eight years regarded as the normal life of such vehicles and were built before the introduction of high compression engines. The value of high octane fuel to these antiquated machines is, to say the least, problematical and it is likely that many motorists may defer the purchase of the more expensive brands of petrol until they can acquire cars better fitted to make more effective use of them.

The introduction of premium grades, however, should encourage motor manufacturers to raise the compression ratios of their engines, thus giving more economical performance and enabling them to compete more favorably in export markets.

In connection with a release by the government of premium grade spirits, it is interesting to note that the 10,000 b/d catalytic cracking plants of the Anglo-Iranian Oil Company's associates at Llandarcy and Grangemouth have been completed and put on stream during the past month, and so will add their quota to the production of premium grade for this company.

Book Review

A.S.T.M. Manual of Engine Test Methods for Rating Fuels; edited by the Committee D-2 on Petroleum Products and Lubricants; published by American Society for Testing Materials, Philadelphia, Pa.; 360 pages; $8.00.

The second edition of this manual contains all the changes that have been made in the methods of rating motor, aviation, and diesel engine fuels that have been adopted since 1948. The six extensively revised supplements contain information on the best practices currently in use for laboratory facilities, installation of the test engine units, provision for reference materials, and electrical, water and air services. An important improvement is the inclusion of an extensive and very useful index. Another important improvement is a modification of the motor and research methods that provides for the use of a detonation meter as an alternative for the "bouncing pin" in the earlier edition to determine knock intensity.

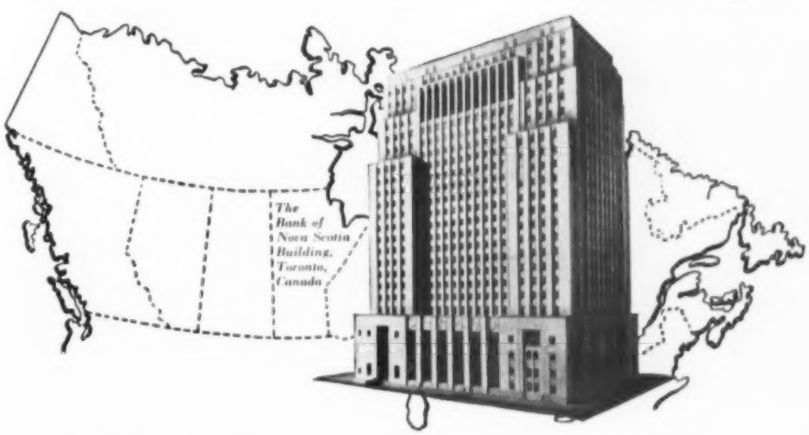
Paul Bowen Heads S. R. Bowen Company

Paul Bowen was recently appointed president of the S. R. Bowen Co., succeeding the late Jack Wilcox. Paul Bowen is the son of S. R. Bowen, founder of the company. Starting in the Bowen office in 1930, Paul spent many years in the sales and service departments and was store manager at Santa Maria, Calif. and Casper, Wyo. For the past several years he has been president of Bowen Fishing Tool Co. and vice president of S. R. Bowen Co.

Soft Asbestos-Neoprene Gasket

A new gasket material, Asbestoprene, has been developed from asbestos and the du Pont Company's synthetic rubber, neoprene. Asbestoprene is made by Victor Manufacturing and Gasket Co., Chicago, and is unusual in that it combines compressibility with heat resistance. The new material fills a gap in gasketing materials between compressed asbestos sheet and cork or rubber.

Canada offers you opportunity



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Phillips Vice President Retires

C. P. Dimit, vice president production, director, and member of the executive committee of Phillips Petroleum Co., retired April 1 after 23 years of service with the company and 50 years of service in the oil industry. L. E. Fitzjarrald succeeds Mr. Dimit as manager of the production department.

Mr. Dimit gained his first oil field experience as a roustabout in the Trenton Rock Field near Van Buren, Ind. In 1910 he was attracted to the oil fields of Oklahoma and went to work for the Gulf Pipe Line Co. as assistant warehouse foreman at Watkins. By 1922 he was general production superintendent of Gulf's Gypsy Oil Co. In 1929 he went with the Independent Oil and Gas Co. as vice president and director. When Independent was merged with Phillips in 1931, he moved to Bartlesville, Okla., as assistant to the general superintendent of production, was soon promoted to superintendent, and on April 19, 1932, was named vice president in charge of production. He was elected a member of the Phillips board of directors and of the executive committee on April 26, 1938.

He has served as president of Drilling Research Inc. since its organization in 1949. Supported by 44 drilling, supply and producing companies, this research organization is engaged in finding better and cheaper ways of drilling for oil. Mr. Dimit expects to continue his activities with Drilling Research, Inc.

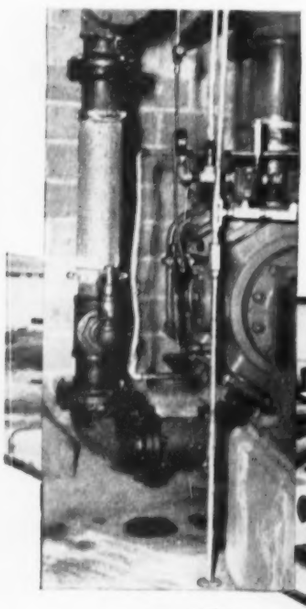
Joins Staff of API

Louis C. Stork has joined the staff of the American Petroleum Institute as supervisor of the new abstracting section now being organized. He left The Texas Company to accept the API position. Since 1946, Mr. Stork has been supervisor of Texaco's Beacon, New York, laboratories.

Schlumberger Promotions

W. J. Lytle, who has been serving as Permian Basin division manager at Midland for Schlumberger Well Surveying Corp., has been transferred to Fort Worth as assistant area manager for northwest Texas. A veteran of 15 years with Schlumberger, Mr. Lytle has been an engineer in several locations throughout Texas. He is succeeded in Midland by George Decker, former Kansas division manager.

R. K. Forsythe becomes Kansas division manager at Wichita. He was formerly in Calgary, Alberta, and was located for several years in California. H. W. True has been appointed south Louisiana division manager with offices at Gretna. He replaces H. A. Nystrom, who was recently transferred to the Houston office. Mr. True was formerly Mississippi Division manager at Jackson. The new manager of the Mississippi Division is T. A. Morris, district manager at Harvey, La.



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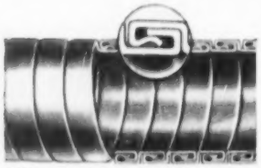

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Saskatchewan Stratigraphy

A report on the Ordovician and Silurian stratigraphy of North East Central Saskatchewan has been prepared by W. O. Kupsch, assistant professor of geology at the University of Saskatchewan.

Field work for the report was conducted in the Namew Lake-Ballantyne Bay area. The subsurface geology study covers the Prince Albert-Hudson Bay Junction area. The report, which is Report No. 10, the Ordovician and Silurian Stratigraphy of East Central Saskatchewan, may be obtained from the mines branch of the Department of Natural Resources for a fee of $1. It will be of particular interest to oil companies drilling in the province, as it describes the outcrop sections of the Ordovician and Silurian in the province.

Navy To End Alaska Exploration

Navy Secretary Anderson has informed the House Armed Services Committee that exploration for oil in the Pt. Barrow, Alaska area designated as a Navy reserve is being suspended and that the Navy will cancel its request for an appropriation of $9,700,000 asked to cover continuation of the work during the coming year. The decision, concurred in by Capt. Robert H. Meade, director of Naval Petroleum Reserves, was based on the ground that further expenditure at this time would be "beyond economic justification." The area will be kept as a reserve for possible future development.

Dual Burner

The development of a new dual stage burner combining steam and mechanical atomization was announced recently by the National Airoil Burner Co. of Philadelphia. It has been tested in the power, petroleum and chemical industries. Oil entering the burner is first mechanically atomized in an internal swirl chamber. After leaving the mechanical stage, the partially atomized fuel is sprayed into a mixing chamber where it is further atomized by steam. Capacities from 80 to 300 gph have been obtained. A detailed description is available in National Airoil Bulletin 25.

New Antioxidant

Impruvol 33, an antioxidant for motor and aviation gasoline to protect from fuel sludge and gumming, has been announced by the Chemical Division of Koppers Company, Inc., Impruvol 33 is a 33⅓ percent by weight solution of di-tertiary-butyl-para-cresol in toluene which is used as an antioxidant for turbine lubricating oil and transformer insulating oil, for waxes and vegetable oils, and for rubber. The new product can be added early in the refining process without loss in subsequent operations.

Husky Names Lee

Lawrence W. Lee has been named executive vice president, general manager and director of Husky Oil & Refining Ltd. of Calgary, Canadian affiliate of Husky Oil Co. of Casper, Wyo.

Turkey Places Contract for Refinery With Parsons Co.

Following the decision of the Turkish government in November last to denationalize its petroleum industry, announcement was made at Ankara in February that an agreement had been made with the Ralph M. Parsons Company for the erection of a refinery to process crude from the Raman and Garzan fields in the eastern part of the country. The Parsons Company will handle the engineering work in connection with the refinery and will have charge of the construction of the plant together with its accessories, including storage tanks, a laboratory, a machine shop, oil drum repair facilities and a pipe line 26 miles long connecting the refinery with the oil fields.

The complete installation is estimated to cost about $7 million and to be finished in two years. The engineering company is to receive a flat fee of $425,000 for its services, plans and specifications, and will operate the plant for one year after its completion.

In issuing its decree of denationalization, the Turkish government announced that it had decided to take such legislative, administrative, and financial measures as will permit the Turkish government to attract and conclude agreements with foreign individuals and corporate entities possessing capital who will undertake to prospect for, locate, develop, or cooperate in the development of Turkey's oil resources within the framework of world petroleum policy and on terms most advantageous to Turkey's military and economic interests. The decree invested government with full authority to utilize the services of specialists experienced in the field and in the technical, economic, and financial aspects of international legislation and its implementation with respect to petroleum, in order to determine in consultation with them the conditions of investment and cooperation that are to be applied.

Since August 1951, foreign capital brought into Turkey has been assured of enjoying the special rights and privileges of the law on condition that it (1) contributes to the development of Turkish economy, (2) is used in fields normally open to Turkish private capital, (3) does not involve the granting of a monopoly or concession of any port, and (4) is invested in the sphere of industry, power, mining, public works, communications, and the tourist trade.

Annual profits, interest, and dividends not exceeding 10 percent may be transferred abroad in the original currency of investment, and all or part of the invested capital itself may be transferred abroad after a certain lapse of time.

Bulletins from Colorado School of Mines

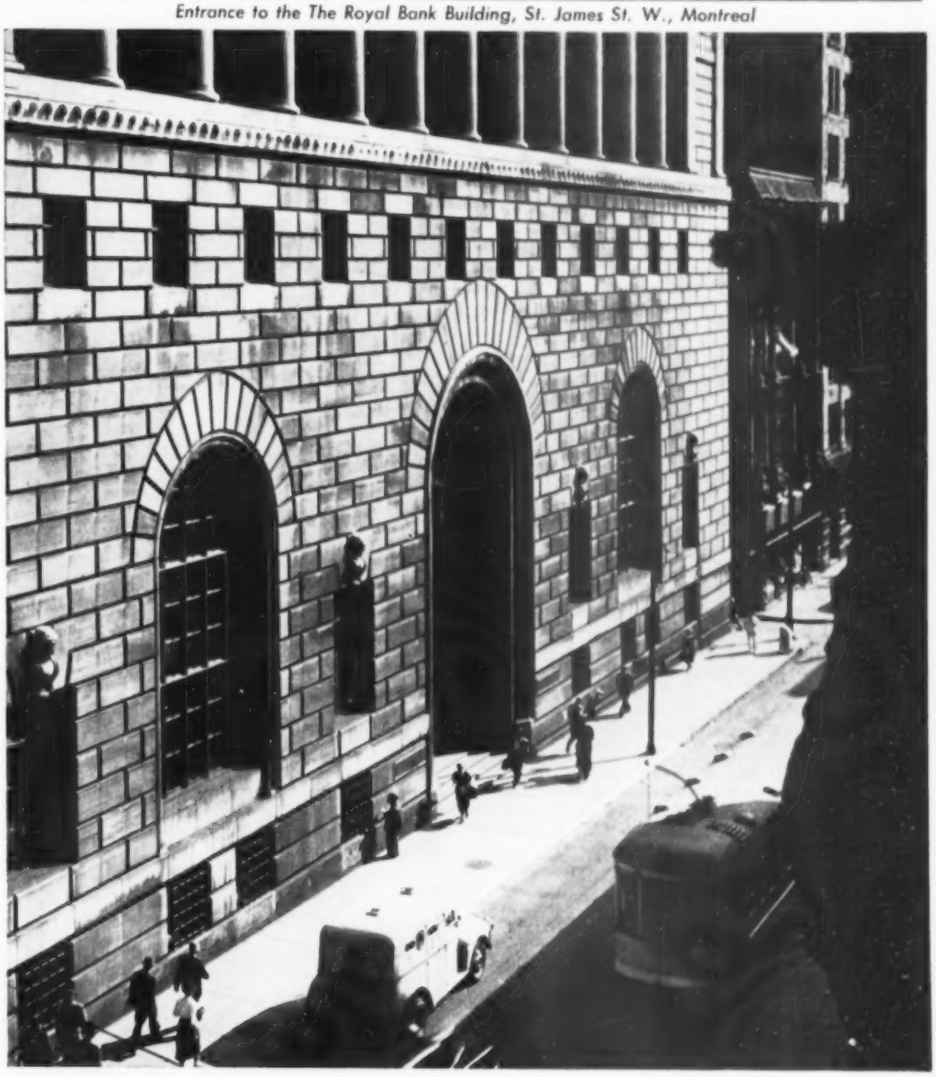
Examination of Well Cuttings, by Julian W. Low; published by Colorado School of Mines, Golden, Colo.; 48 pp.; 1951; $1.50.

This is a manual for a microscopist-petrographer who has taken on the job of studying the rock fragments brought to the surface in the drilling of oil wells; from such examinations he will construct a "petrographic log" which will show the inner characteristics of strata penetrated by the drill, such information being of great help to the oil geologists. The tools and working methods used in these studies are well and comprehensively described.

Removal of Sulfur From Petroleum Coke, by Frederick K. Sabott and William C. Schafer; published by Colorado School of Mines, Golden, Colo.; 37 pp.; 1952; 50 cents.

The demand for petroleum coke for making anodes is greater than the supply. Buyers insist on 0.50 per cent or less, though some are content with 2 percent. Only coke from Pennsylvania low sulfur crudes meets this specification. In the hope of widening this market to other crudes, the authors have studied all possible chemical methods, very few of which remove more than about 27 percent. However, Sabott found that when a coke is heated with unsaturated hydrocarbon gases, more than 90 percent of the sulfur is removed, reducing it to 0.1 percent or less. Whether a technical process can be founded on this fact remains to be seen.

Entrance to the The Royal Bank Building, St. James St. W., Montreal



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OIL COMPANY STAFF CHANGES

GEORGE E. TEMPLE has been appointed vice president and general manager of Catalytic Construction of Canada, Ltd., with headquarters at Sarnia, Ont., Canada. Mr. Temple succeeds Gordon R. Henderson, who resigned to become manager of the new 15,000-barrel refinery of Sun Oil Co. also at Sarnia.

Prior to joining Catalytic, Mr. Temple was associated with the Anglo-Iranian Oil Company, Ltd. for 16 years. He joined Anglo-Iranian in 1935 as a plant operator at Abadan, Iran. In 1940 he was advanced to process superintendent at the Naft-i-Shah refinery and was named refinery superintendent at Kermanshah in March, 1943. In 1944 he was appointed chief operator of the storage and export department at Abadan where he initiated the reorganization and extension of product loading systems which raised the export tonnage handled from 18 million to 25 million tons a year.

In 1947 he was named assistant works manager in charge of personnel at Abadan. He left the company in 1952 following nationalization of the properties by the Iranian government.

G. E. Temple

J. W. PITTMAN, Shell Oil Company's New Orleans area production superintendent and former Lake Charles production division manager, has been named production manager for the southern states area east of Texas, with headquarters in New Orleans, to succeed E. N. Van Duzee, recently assigned to New York.

Mr. Pittman started with Shell as a roustabout at Kilgore, Texas, nearly 20 years ago. Only interruption of his service with Shell came in February 1942, when he went into the Army. He was discharged in October 1945, as a lieutenant colonel, having been decorated with the Bronze Star with two oak leaf clusters, the Infantry Combat Badge and three area theater ribbons with three campaign stars.

A. R. Heidebrecht

ALLEN R. HEIDEBRECHT, senior electrical engineer for Platte Pipe Line Co., has been promoted to chief engineer with headquarters in Kansas City, Mo. He joined Platte in 1950 after 16 years with Kansas Gas and Electric Co. Platte Pipe Line Co. recently completed a 100,000 b/d crude oil pipe line from the Rocky Mountains to Wood River, Ill.

EARL D. WALLACE, director and vice president in charge of production of Standard Oil Co. (Ohio) and president of Sohio Petroleum Co., has resigned to join the New York investment firm of Dillon, Read & Co., in connection with its numerous large investments in oil properties. Mr. Wallace joined Sohio in 1942 as manager, land and production. Prior to this, he had been with the Petroleum Exploration Co. and the Wiser Oil Co. He was also president of the People's Gas Co. of Kentucky. During this period of service with Sohio, the company's net crude oil production rose from less than 1,000 barrels per day to almost 34,000 barrels per day.

E. P. HAYES, former chief petroleum engineer for The Texas Co., has been appointed chief petroleum engineer of the producing division of the California Texas Oil Co. Ltd.

After serving in an aviation unit in France in World War I, Mr. Hayes was an engineer with the U. S. Bureau of Mines for a number of years. He joined The Texas Co. as petroleum engineer in the South Texas division in 1933. He became division engineer in 1937, holding that position until October 1946, when he was appointed chief petroleum engineer of the producing department.

E. P. Hayes

WILLIAM F. WADT has been appointed general superintendent of the Bayonne refinery of Esso Standard Oil Co. to succeed Geo. A. Esty who will retire later this year. Charles Leet has assumed the new position of manager of the Bayonne refinery.

Mr. Esty came to work as a laborer at the refinery in September 1916. Not long after he was promoted to foreman, and in August 1928 he was named assistant process superintendent. He became process superintendent in May 1931, assistant general superintendent in June 1944, and general superintendent in March 1948. His 37 years with the company included assignments in Halifax, Montreal, Havana, Sumatra and in various locations in the United States. He assisted in the initial operations at Port Jerome, France.

Mr. Wadt was employed at Bayonne from June 1933 to February 1945, serving successively as a test engineer, a foreman of the phenol plant, assistant to the head of the paraffin department, technical assistant to the process department head, assistant process superintendent and process superintendent. He became coordinator of process operations for the New Jersey works in 1945, and assistant to the vice president in charge of manufacturing in 1946. He was named assistant general superintendent of Bayonne refinery in May 1948.

Mr. Leet started with the Esso organization as a student engineer at Bayway refinery in 1930. In 1939 he became head of the process engineering department at Baton Rouge, La. He was named head of the technical division in 1946, and assistant manager of the Baton Rouge refinery on February 1, 1930.

R. O. DUNBAR, formerly a geophysical supervisor in Phillips Petroleum Company's Bartlesville office, has been transferred to assistant division geologist for the northwest division.

H. E. Garrett, formerly assistant district geologist at Ardmore, Okla., has been transferred to division staff geologist for the northeast division. J. T. Clark, formerly district geologist at Jackson, Miss., has been named assistant division geologist for the northeast division. All three will have their offices in Bartlesville.

B. D. Bounds, formerly district geologist at Evansville, Ind., will move to Jackson, Miss., in the same capacity. J. C. Smith, Jr., formerly division staff geologist in the northeast division in Bartlesville, has been transferred to the position of district geologist at Evansville, Ind.

A. LUDLOW CLAYDEN has been appointed technical associate in Sun Oil Company's chemical research and development department with his assistant, John G. Moxey, Jr., succeeding him as manager of the company's automotive laboratory.

An authority on fuels and engines, Mr. Clayden joined Sun in 1922 as chief automotive engineer, following an extensive career in the automotive engineering field both here and abroad. He became manager of the automotive laboratory at Marcus Hook in 1938.

Mr. Moxey entered the "engine lab" in 1935 as a laboratory assistant.

FRANK W. BOWEN has been appointed superintendent of Sun Oil Company's refinery now under construction at Sarnia, Ont. He was formerly chief chemical engineer at Sun's Toledo, Ohio refinery.

Mr. Bowen joined Sun at its Marcus Hook, Pa. refinery after completing graduate work at Cornell University. He has been chief chemical engineer at the Toledo refinery since 1944.

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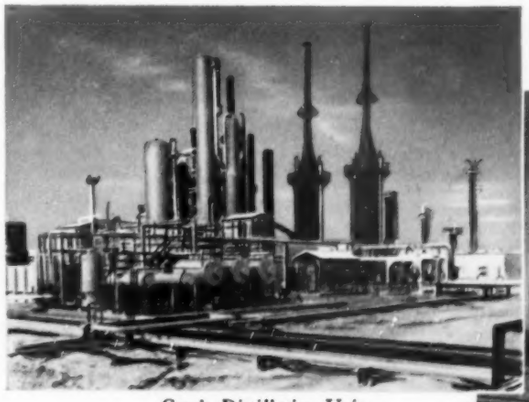

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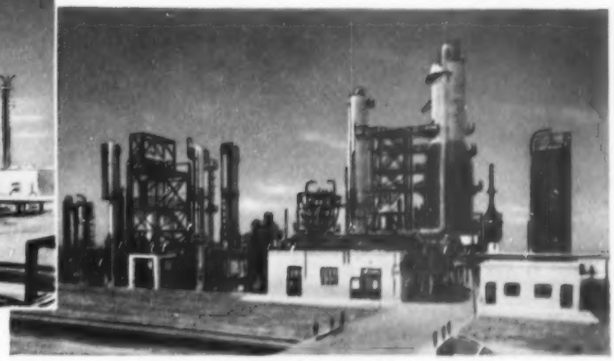

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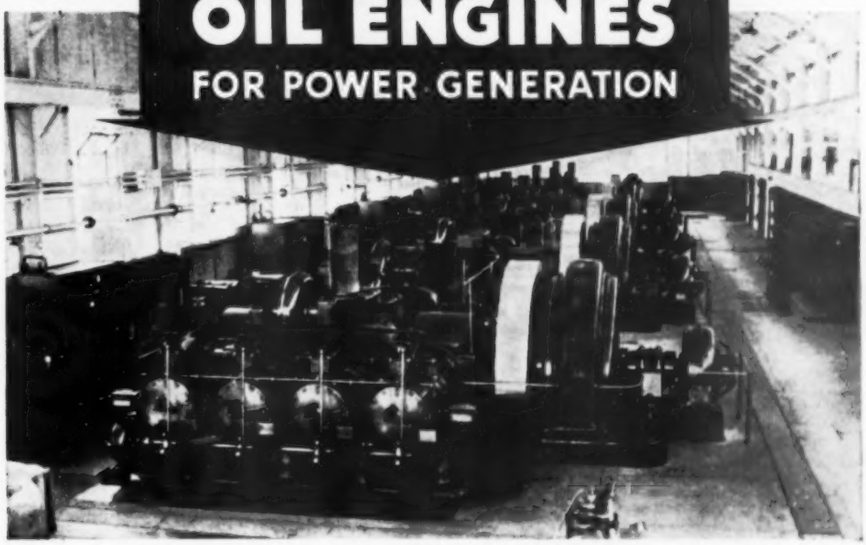

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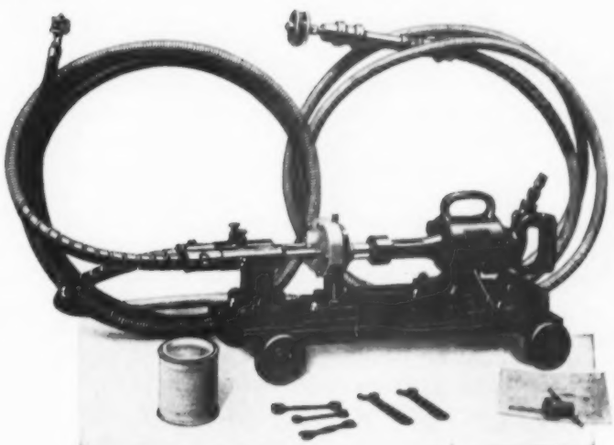

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H. P. SOLEM, New York City, east coast division marketing manager for Continental Oil Company, has been promoted to the newly created position of general manager of petrochemical sales. He will direct sales of Conoco petrochemicals produced at company plants at Baltimore, Md., Trainer, Pa., and Chicago. E. S. Karstedt, Jr., New York City manager of export sales, will succeed Mr. Solem as east coast division marketing manager and will continue to handle export sales.

CHARLES E. CURRY has been appointed superintendent of pipe line operations for Standard Oil Co. of Ohio. He has been acting superintendent. Earl G. Ellerbrake was made operations staff assistant. Both will be at St. Louis headquarters.

J. R. VANDEVER, formerly exploitation department general superintendent of Sunray Oil Corp., has been named to a new post as manager of joint operations for Sunray. John H. Douma and C. J. Kerwin, who formerly have been assistant general superintendents in the exploration department, have been named southern division superintendent and northern division superintendent respectively.

Additional departmental personnel changes include the appointment of M. S. Patton, Jr. to be development advisor of the department, and J. F. Adkisson, Jr. to be technical advisor.

V. L. Smith, formerly assistant Oklahoma district superintendent at Oklahoma City, has been named superintendent of the Oklahoma district for Sunray. He succeeds R. A. Summers, who has been transferred to Tulsa as head of a new safety and training section.

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N. D. SMITH, JR., has been appointed director of the exploration and production research division of Shell Development Company with headquarters in Houston. Following graduation from the University of Texas, Mr. Smith received the degrees of M.A. and Ph.D. in physics from Harvard University. He joined Shell in 1935 as a seismologist. In 1945, after a three-year leave of absence for service in the Navy, he was appointed manager of the physical department in Shell's exploration and production research laboratory in Houston. He has been manager of the laboratory since 1947.

G. W. HART, superintendent of measurement for General Petroleum Corporation, has been appointed assistant manager of the gas department at Vernon, Calif. With General Petroleum since 1934, he has worked in gas plants at Athens, Santa Fe Springs and Lebec.

A. L. Saulsbury has been named senior drilling foreman for the production department's southern division at Vernon. With General Petroleum since 1916 on oil field drilling operations, he advances from his former post of drilling foreman at Wilmington.

LEON G. DUFILHO has been appointed manager of refineries of Eastern States Petroleum Co., Inc., in Houston.

Mr. Dufilho began his oil career as an engineer with the Louisiana Oil Refining Corp., Shreveport, La., and was for two years chief engineer for the Lion Oil Co. of El Dorado. For the past 19 years he has been with Premier Oil Co. in Longview, Texas. Prior to coming to Eastern States, he was director of refineries for two years.

T. J. STEVENSON, president and chairman of T. J. Stevenson & Co., Inc. and of Ocean Freighting & Brokerage Corp., has announced formation of Stevenson, Vining Corp. as the tanker division of Ocean Freighting & Brokerage Corp. The John F. Vining Co. has been dissolved. John Vining is vice president of the Stevenson, Vining Corp. He will continue to devote his personal attention to tanker brokerage.

W. V. ISCHIE, formerly operating superintendent of Sinclair's East Chicago refinery, has completed his tour of duty with the Petroleum Administration for Defense and has been appointed assistant to the manager of refineries of Sinclair Refining Co. He will make his headquarters in New York. During Mr. Ischie's tour of duty with the PAD, he served as director of refining in the foreign division.

MAJOR JAMES R. LOWERY, founder and former president of Home Oil Company Ltd., has found it necessary for personal reasons to retire as chairman. He has been with the company for 27 years. While his direct association has been withdrawn, he will remain as consultant to the company. R. A. Brown, Jr. has been appointed chairman to fill the vacancy created by Major Lowery's retirement.

DONALD I. LAWLESS, manager of exploration for Canadian Bishop Oil, Ltd., has been elected a director of the company. Presently stationed in Calgary, Alberta, Mr. Lawless has been prominently identified with the activities of Bishop Oil Company, the American parent company, in midcontinent fields. He is a geologist.

JOHN H. YOCOM has been appointed manager of the public relations department of The British American Oil Company Ltd. Mr. Yocom has been managing editor of SATURDAY NIGHT magazine for the past four years.

REESE H. TUCKER has been elected a director of Cities Service Oil Co. (Del.). He is manager of the land and geological division of the company. He first joined Cities Service in 1930 as a junior engineer.

M. J. Wells

To Build Second Platformer

Aurora Gasoline Company, Detroit, will install a 1,500-barrel UOP Platforming unit at its Elsie, Mich. refinery. Aurora has been operating a Platformer at its Detroit refinery since September, 1951. The unit at Elsie, like the one at Detroit, will be designed to produce high octane motor fuel. Construction contract has been awarded to Procon, Inc.

Continental Buys Chemical Plant

Continental Oil Company has purchased the plant and manufacturing facilities of the Bryton Chemical Company of Trainer, Pa., about 20 miles southwest of Philadelphia, it is announced by Harold G. Osborn, vice president in charge of manufacturing.

Bryton was one of the first producers of synthetic oil-soluble sulfonates for use in industry. Its products are used in lubricating oil additives, dry-cleaning detergents, and textile, cutting and leather finishing oils.

James A. Moffett

James A. Moffett, a former senior vice president of Standard Oil Co. (N. J.) and former chairman of the board of California-Texas Oil Co., died in New York on March 26 at the age of 66. Son and namesake of a prominent oil company executive, Mr. Moffett was destined from his earlier years for a career in the oil industry.

He entered the service of Vacuum Oil Co. in 1906 as a clerk, was made manager of sales and assistant to the president of Standard Oil Co. of Lousiana in 1909, was elected a director of Standard Oil Co. (N. J.) in 1919, became a vice president in 1924, and served as senior vice president until 1933 when he resigned to accept appointment as a member of the advisory board of NRA. He was appointed Federal Housing Administrator in 1934 and held that post during the organization of its housing program.

On the organization of the California-Texas Oil Co. in 1936 under the joint ownership of The Texas Co. and Standard Oil Co. of California, Mr. Moffett became chairman of the board and served in that position until his retirement.

Mr. Moffett was active in the work of the National Petroleum War Service Committee organized to handle petroleum supplies for the Allied armed services in World War I. As secretary of the committee he directed the programming and movement of shipments in what proved to be one of the decisive phases of the war. An outgrowth of this wartime committee was the organization in May 1919 of the American Petroleum Institute.

MURRAY J. WELLS, division geologist for Cities Service Oil Co. at Casper, Wyoming, has been named division manager of exploration for the northwest division with headquarters at Casper. He will continue to act as division geologist. Walter W. Wittlinger is division land man.

FERNANDO PADILLA, former financial manager of Petroleos Mexicanos in New York City, has been named general manager of Pemex by President Adolfo Ruiz Cortines.

A. L. HENDERSON, Terre Haute division manager of The Ohio Oil Co., retired March 1 after 36 years with Ohio Oil. E. B. Stewart, district manager at Sidney, Nebraska, will succeed Mr. Henderson and J. S. Leonard, Houston division drilling superintendent, has been appointed Sidney district manager.

W. E. SMITH has been appointed assistant purchasing agent of The British-American Oil Producing Co. at Dallas. He was transferred from the company's western division office at Los Angeles to the headquarters office in Dallas.

E. F. BULLARD, president of Stanolind Oil and Gas Co., Tulsa, has been elected a director of the First National Bank and Trust Co. at Tulsa. Mr. Bullard has been president of Stanolind since 1945. He was made director-in-charge of exploration for Stanolind in 1932 and was elected successively vice-president, director, executive vice-president, and president of the company.

W. W. REICHENBACH has been appointed manager of the oil supply and exchange department of General Petroleum Corp. He has been assistant manager of the department since 1949.

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Plan Well in Sicily

The first step in exploring the production possibilities of 30,000 acres of wholly-owned concessions in Sicily has been taken by the Macmillan Petroleum Corp. William Ross Cabeen, consulting geologist, will choose a location for drilling of an exploratory well. The Macmillan acreage is located in southeast Sicily between large holdings of the American International Fuel and Petroleum Company, a Gulf subsidiary, and the D'Arcy Kuwiat Co., Ltd., an Anglo-Iranian Oil Company subsidiary.

According to a recent issue of Walker's News Letter, "Gulf Oil is sending a drilling crew to start an exploratory well on Gulf's concessions on a location adjoining Macmillan's wholly owned concessions of 30,000 acres. On the other side of Macmillan's holdings, Anglo-Iranian plans an exploratory well. Gulf also expects to drill a wildcat on concessions of Mediterranean Oil Company sometime this year." Mediterranean is a subsidiary of Gulf and Macmillan and holds 220,000 acres.

Mexico To Expand Operations

In a report on Mexican oil operations during 1952, Senator Antonio J. Bermudez, director general of Petroleos Mexicanos, stated that the country's oil reserves stood at 2,200 million barrels at the close of the year, up 22.4 percent from 1951. He stated that three important new fields discovered during the year were Rio Bravo, Los Soldados and Mozutla.

Production during the year was given as 78,910,000 barrels. Exports declined to 15.4 million barrels as compared with 22.4 million in 1951.

Senator Bermudez outlined the drilling program for 1953 as calling for a minimum of 400 wells, including 75 wildcats. Other plans call for raising the daily capacity of the Azcapotzalco refinery from 50,000 to 80,000 b/d and of the Salamanca refinery from 30,000 to 40,000 b/d together with enlargement of the Reynosa refinery.

Geological Study in Turkey

The government of Turkey, in line with its new policy, has authorized the Standard Oil Co. (N. J.) to send a geological reconnaissance party into that country to conduct a survey of prospective oil areas. Late last year, the Turkish government announced its decision to encourage foreign capital to participate in the development of its resources. Later it de-nationalized its oil policy and invited foreign oil companies to participate in the search for oil. This action reversed a practice of government-controlled enterprise that had been in effect in Turkey for many years.

Petroleum legislation is now under study by the Turkish government under which it is expected that a favorable climate will be created for the mutually satisfactory development of the oil resources of that country.

Book Review

Minerals—A Key to Soviet Power, by Dmitri B. Shimkin, Harvard University Press, $8.

Dr. Shimkin, research associate of the Russian Research Center at Harvard, has compiled a review of mineral economics in the U.S.S.R. for the period 1926 through 1950 on the basis of official Russian Government documents and other publications. Output and reserves of satellite countries are treated also.

One chapter in the book is devoted exclusively to petroleum. In addition the generalized introductory material and the author's conclusions contribute to the information of the student of the Russian oil industry.

As in all other mineral industries in Russia, development has been retarded by the war and other factors with the result that Russia is an importing nation. The author concluded, however, that vast reserves are available and can be produced in the future. He believes that a generation may elapse before the mineral industries of the country may reach full stride.

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C. T. Foster *H. D. Henderson* *F. H. Willibrand* *D. Crary*

CLYDE T. FOSTER, president of the Standard Oil Co. (Ohio), has been elected president of the Sohio Petroleum Co. following resignation of Earl D. Wallace. As president of both companies, Mr. Foster announced the promotion of Richard W. French, vice president in charge of production operations, Sohio Petroleum Co., to a new post as general manager of all Standard Oil (Ohio) and subsidiary exploration, land, and crude oil production activities.

Mr. Foster also announced that George S. Buchanan, vice president, land and exploration, Sohio Petroleum Co., has resigned.

Frank H. Willibrand, formerly manager, production operations, of Sohio Petroleum Co., has been named manager of the mid-continent division with headquarters at Oklahoma City.

Howard D. Henderson, formerly manager, land and exploration in the United States, has been appointed manager of the Gulf Coast division with headquarters at Houston.

Donald Crary, formerly superintendent of domestic exploration, has been made manager, northwest division, with headquarters at a location to be selected. The Casper, Lewiston and Regina offices are included in the northwest division.

Mr. Willibrand entered the oil industry in 1919 as a helper on a core drilling machine for the Shell Co. of Calif. He resigned from Shell to take a course in petroleum engineering and later worked for Phillips and Sunray before joining Sohio at Oklahoma City in 1943.

Mr. Henderson was with Continental Oil Co. for 16 years in various land department positions. He joined Sohio at Houston in 1946 as assistant division land superintendent. He was elected an assistant vice president in 1949.

Mr. Crary joined Carter Oil Co. as a geophysical assistant in 1938 and later was a party chief on geophysical work for Independent Exploration Co. He joined Sohio in 1946 and in 1949 was made superintendent of exploration.

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Launching of "Safety" Tanker

The turbo-electric steam tanker "Helix," of 18,000 dwt, has been launched from the Wallsend-on-Tyne yard of Swan Hunter and Wigham Richardson Ltd. The novel safety features embodied in this vessel have been designed and developed by Shell's marine research department under the leadership of John Lamb.

These safety features are designed to eliminate the risk of fires and explosions due to escaping gases. The first aim of preventing gas escapement from the tanks is achieved by special equipment which makes it unnecessary to uncover any opening in the tanks, either for loading or discharging, or to obtain any information regarding the cargo's volume or other characteristics. If, however, there should be an accident and dangerous gases do escape, they are prevented by other devices from entering those parts of the ship where naked lights are in use, such as the galley, the boiler room and the smoke room.

Another feature to be incorporated in the "Helix" for the first time on any ship is an electrically-operated overside lift. This patented lift, which will transport six persons or 10 cwt of stores at one time, is not affected by the list or trim of the vessel and is not dependent upon guide rails. It will considerably ease the difficulty of getting on or off an oil tanker, which, as its cargo is discharged, rises up in the water to such an extent that the gangway is often at a very steep inclination. Important too, as an aid to hygiene, is the fact that the lift helps to prevent rats getting on or off the ship.

The cargo pumping equipment is also unique. The centrifugal pumps are vertically disposed and driven by steam turbine engines, and a novel cargo pipeline enables this single pumproom ship to carry at one time the same number of different grades of petroleum as a ship having two separate pumprooms.

Messrs. Harland and Wolff announce that the single-screw steam turbine tanker "Harpa," of 18,000 dwt, building to the order of the Anglo-Saxon Petroleum Co. Ltd., was successfully launched from their Belfast shipyard on January 29.

The "Harpa" is the latest of a series of tankers which Harland and Wolff have built for these owners and is one of the new Shell standard general purpose tankers. The builders have further tankers under construction or on order for the Anglo-Saxon Petroleum Co.

Harland & Wolff also announce that the single screw motor driven oil tanker "Clydefield," of 16,000 dwt, built at their Govan shipyard to the order of Messrs. Hunting & Son Ltd., Newcastle, has successfully completed her sea trials and has been handed over to the owners.

Bevel Again Heads British Empire Oil

John H. Bevel of Calgary was re-appointed president of British Empire Oil Co. Ltd. following the annual and special meetings of shareholders in Calgary April 8. Frank B. Bateman of New York was named vice president. Directors include Mr. Bevel, Mr. Bateman, Clifton C. Cross, Robert B. Curran, John M. Dillon, Jr., all of Calgary, and Reginald Atherton of Vancouver.

British Empire has one of the largest acreage interests in the Peace River gas development area of any independent company.

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Orbit Valve Appoints Canadian Representative

Tom R. Pickford, well known in Canadian oil equipment circles, has been appointed to represent Orbit Valve Company of Tulsa in the Provinces of Alberta, Saskatchewan, British Columbia and Manitoba in western Canada. He will headquarter at Calgary with offices at 536 Eighth Avenue West. He was formerly with Oil Equipment Ltd., a Canadian supply company. According to R. G. Cole, general sales manager for Orbit, Mr. Pickford took over his new position April 1.

Florida Wildcat

Sinclair Oil and Gas Company has begun drilling on Key Largo, its first wildcat well in that state. The well is located in Monroe County, about 40 miles south of Miami. Known as the No. 1 H. R. Williams, the test is located on a block of 171,500 acres, part of which is on Key Largo, part in the shallow sounds and bays toward the mainland, and part on the ocean side of the key. Sinclair obtained a one-half interest in the block late in 1952 from the Commonwealth Oil Company, one of the considerations being the drilling of this wildcat well to a depth of 10,500 feet.

Dewpoint Measuring Equipment

A new eight-page two-color bulletin on dewpoint measuring equipment for continuous accurate indication and recording of dewpoint temperature in a gas stream has been announced as available from the General Electric Co., Schenectady 5, New York. The booklet (GEC-588A) contains photographs and diagrams of the G-E dewpoint indicator and recorder; gives applications, descriptions, and operation principles; and provides a chart showing the relation between dewpoint and moisture content of gases.

T. R. Pickford

H. M. Houghton

To Service Oil Accounts

Hill & Christopher, Los Angeles agency, has appointed William R. Graydon as a copywriter to service the firm's petroleum and other industrial accounts. Mr. Graydon, formerly of the Los Angeles Mirror, specialized in writing industrial features that ranged from electronics and geophysical stories to heat-treating and plastics manufacturing. Hill & Christopher is the advertising agency for Halliburton Oil Well Cementing Co.

Names Export Aide

Fred R. Ellenberger has been appointed assistant to the vice president in charge of foreign business for Worthington Corp., according to an announcement today by S. R. Williams, vice president in charge of foreign business. Mr. Ellenberger joined Worthington in 1938. He has since served as production expediter, methods engineer, sales engineer, and manager in charge of the export section. He has been with the Export Department since 1945.

Appointed General Manager of Geophysical Prospecting Co.

H. M. Houghton has been appointed general manager of the Geophysical Prospecting Co. of Canada Ltd. He succeeds T. J. Randell, who is returning to London to resume his post as managing director of the parent company, The Geophysical Prospecting Co. Ltd.

Mr. Houghton formerly was geophysical supervisor for Amerada Petroleum Corp. in Canada. He joined Amerada first in 1929 and subsequently was with Tide Water Associated Oil Co. up to the war, during which he did technical work on the Manhattan Project at Los Alamos, N. M. He rejoined Amerada in 1946 and came to Calgary late that year.

An associate company of *International*, in the course of its operations, is passing on to the main U.K. factory at Felling-on-Tyne the benefit of its *on-the-spot* experience, and in return is deriving advantage from the wealth of technical knowledge which this central factory has amassed.

And in 14 other cities associated companies are doing likewise. Thus *International*, with this world-wide co-operation, is able to produce paints for every climate and purpose. For the Oil Industry *International* RED LEAD GRAPHITE PRIMER and *International* ALUMINIUM PAINT are made for storage tanks. SUNLIGHT SYNTHETIC ENAMEL is for all general purpose use. And there are many specialities, too, such as DRUM PAINTS and TANCTECTOL, a paint that is resistant to benzine, petroleum, white spirit, etc. and is used in the interior of storage tanks, road and rail cars, etc.

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Government Synthetic Plants Opposed

In a report submitted to the National Petroleum Council on February 27 as the result of a two and a half year study by a special committee headed by W. S. S. Rodgers, chairman of The Texas Company, the Council was advised that Bureau of Mines proposals for the manufacture of synthetic gasoline from coal and oil shale are "definitely uneconomical under present conditions" and that "the need for a synthetic liquid fuel industry in this country is still in the distant future."

In its summary of the study, the NPC also cast doubt on the value of the Bureau of Mines' multi-million dollar demonstration plants and questioned "the wisdom of government financing" of these huge experimental units.

The committee estimated as a result of careful study that gasoline manufactured from oil shale would cost the wholesale purchaser 14.7 cents a gallon at the refining point, that gasoline made from coal by the Bureau of Mines Fischer-Tropsch process would cost 29.4 cents a gallon, and gasoline made from proposed hydrogenation processes would cost at least 36.3 cents a gallon.

These wholesale prices would all exceed the current wholesale price of gasoline refined from crude petroleum, which is about 12 cents a gallon at the refinery or terminal. Wholesale prices do not include sales taxes and marketing and transportation expenses.

It pointed out that when the need arises in the U.S. for synthetic gasoline, entirely new techniques, now unknown, may be available. "Such techniques," the NPC said, "can be developed from well-designed pilot plants at a fraction of the cost of the big, expensive demonstration plants."

Since 1944 over $74 million has been appropriated for the Bureau of Mines Office of Synthetic Liquid Fuels for its development program.

The NPC undertook its two and half year investigation of the Bureau's design and cost data at the request of the Secretary of the Interior.

GSI Service Awards

Following completion of GSI's first annual series of service award programs, a total of 194 GSI employees are wearing emblems awarded for a collective total of more than 2,200 years of experience with the geophysical exploration organization. Awards were made at regional programs held in Dallas, Texas, Baton Rouge, La.; Denver, Colo.; Bakersfield, Calif.; Calgary, Alberta; Mexico, D. F.; and Dhahran, Saudi Arabia. This year awards were presented to 11 employees with more than 20 years of experience, to 34 with more than 15 years, to 26 with more than 10 years, and to 123 with more than 5 years.

Hammond Iron Works Bulletin

Hammond Iron Works has published bulletin 53DL to fully describe Dialift tanks, for new storage installations or as a conversion of existing cone roof tanks. Dialift tanks include a membrane which functions as the "lung" of a single or battery of storage tanks. This membrane, attached gas-tight to the inside periphery of the Dialift unit, lifts with the pressure of gas or vapor accumulation and lowers as the gas or vapors diminish, thus eliminating breathing losses and reducing filling losses. Copies of Bulletin DL 53 may be obtained by writing Hammond Iron Works, 630 Fifth Ave., New York City 20.

Watts, Payne Business Increases

The largest volume of business in the 23-year history of Watts, Payne-Advertising, Inc. has been announced following the annual meeting. The firm has offices in Tulsa and Dallas. According to Don Watts, president, the advertising agency's billing was 15 percent above 1952 and well over a million dollars. Watts-Payne is probably the largest agency in the State of Oklahoma, and one of the largest in the Southwest.

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R. T. Garrison

Garrison Joins Muldrow

Richard T. Garrison has been appointed business manager and comptroller of Muldrow Aerial Surveys Corp. He formerly was with an independent oil company in Oklahoma City and is a veteran of 16 years in the oil business and business management.

To Build Vacuum Unit

Standard Oil Co. of California has awarded The M. W. Kellogg Co. the contract for a duplicate of the world's largest vacuum flasher, it has been announced by Russell J. Wolf, vice president in charge of Kellogg's sales.

The unit, which will have a capacity of 55,000 barrels of reduced crude daily, equals in capacity a similar plant Kellogg designed and erected for this refiner over a year ago at California's Richmond refinery. As part of a major refinery improvement program at El Segundo, the vacuum flasher is scheduled to be under construction by July.

Tuscarora Oil Changes Name

The name of the Tuscarora Oil Company, Ltd., affiliate of Esso Standard Oil Company, was changed to Tuscarora Pipe Line Co., Ltd., effective March 16, John W. de Groot, president, announced.

The company's 40,000-barrel products line from Allentown, Penn., to the Ohio River at Midland, Penn., is being rebuilt at a cost of about nine million dollars.

BS&B Promotes McGinnis

W. M. McGinnis has been appointed as Houston district sales manager of Black, Sivalls & Bryson, Inc. He has been with BS&B for the past nine years as a salesman in the Houston office. In his new capacity, he will have supervision of sales and service activities of the controls and safety head division in the Houston sales district.

Siver Heads BS&B Engineering

Black, Sivalls & Bryson, Inc., Kansas City, has announced the appointment of Chester A. Siver as general manager of engineering. He will supervise engineering staffs in Kansas City, Oklahoma City and Tulsa.

E. F. BATTSON, administrative vice president of Continental Oil Co., has been elected chairman of the executive committee of the board, succeeding George Whitney, who has resigned the chairmanship but will continue as a member of the committee.

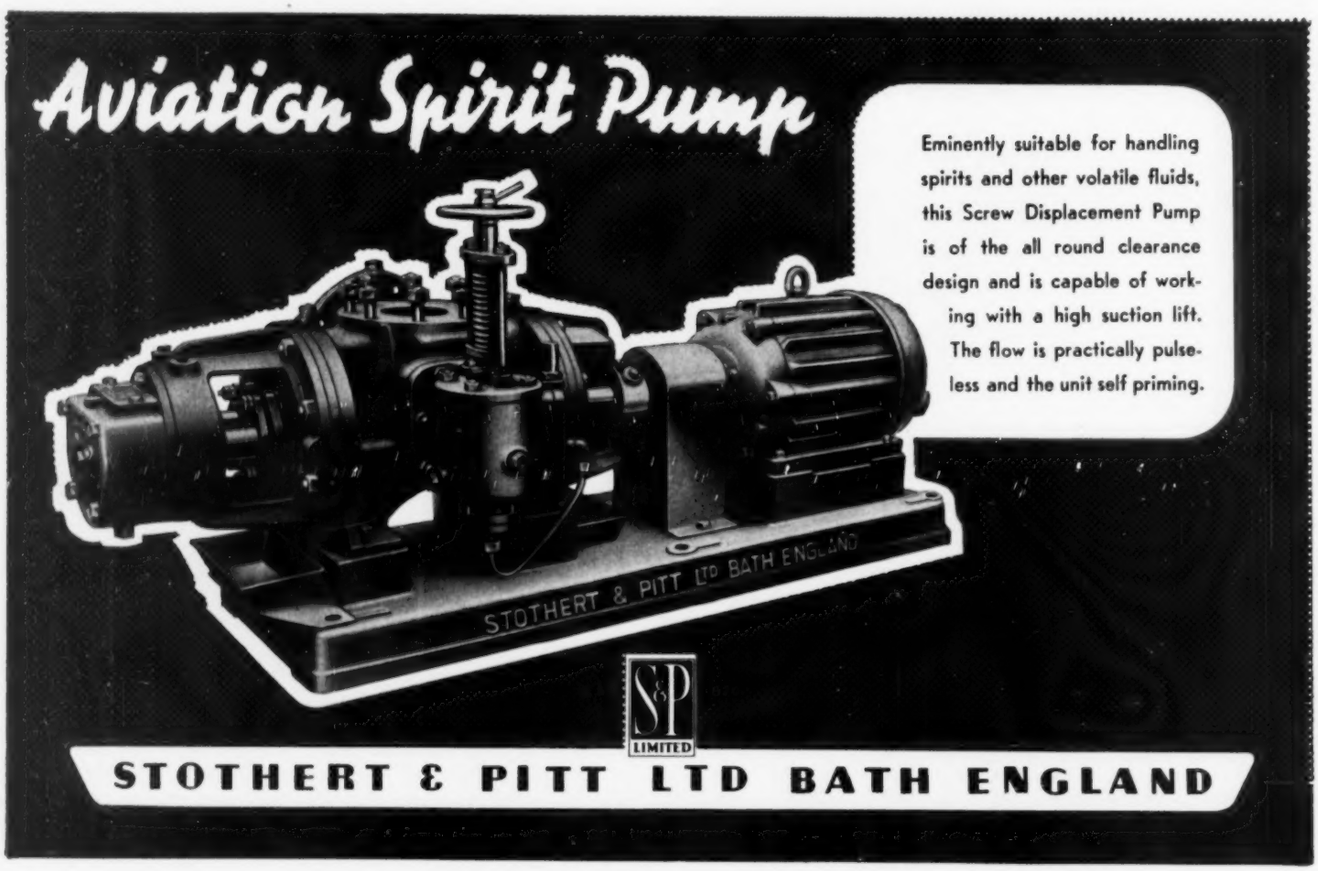
Charles A. Perlitz, Jr., vice president, and Ira H. Cram, vice president in charge of exploration, have been appointed to the newly created positions of senior vice presidents.

Both Mr. Perlitz and Mr. Cram will continue to make headquarters in Houston, but Mr. Battson will establish his offices in New York.

E. F. Battson

C. A. Perlitz, Jr.

I. H. Cram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Exploration Geophysicists Elect Officers

Roy L. Lay of Houston and Dr. Karl Dyk of Tulsa have been elected president and vice-president, respectively, of the Society of Exploration Geophysicists.

Mr. Lay, the new president, is manager of the geophysical division of The Texas Co. in Houston. He joined the company in 1932 and has had wide experience in geophysical operations, both in this country and in Colombia, Venezuela and Egypt.

Dr. Dyk is chief geophysicist of Stanolind Oil and Gas Company in Tulsa. He has been with the company since 1935, serving in field operations before becoming division geophysical supervisor at Fort Worth in 1945. Two years later, he was made geophysical supervisor at Tulsa, and in 1948 became chief geophysicist.

B. W. Sorge, vice-president of United Geophysical Company at San Gabriel, Calif., is secretary-treasurer, and Dr. M. B. Dobrin, a senior research technologist at Magnolia Petroleum Company's field research laboratories in Dallas, is editor.

Shell Has Deepest Producer

A new record for the world's deepest producing well has been set by Shell Oil Company with its No. 1 Weeks-Gall Unit at Weeks Island near New Iberia in the coastal district of Louisiana. Total depth of the well is reported as 17,183 feet with production from 17,038-112 feet. A preliminary test showed a flow of 320 barrels through a 17/64 inch choke for a 24-hour period together with 8,281,000 cubic feet of gas. The oil was stated to be of 39.2 API gravity. Weeks Island is one of the world's deepest fields with a succession of oil bearing horizons below 12,000 feet, and eight of its wells are producing from depths of more than 15,000 feet.

Westinghouse International Promotes Wilcox

George L. Wilcox has been elected vice president, sales, and a director of the Westinghouse Electric International Co. Formerly general sales manager for the company, Mr. Wilcox has been with Westinghouse since 1942 when he joined the parent company as a design engineer. He became associated with the International Company in 1943. Since that time he has held managerial positions in manufacturing, engineering and sales with the International Company and subsidiaries.

Holman Appointed to Security Council

Eugene Holman, president of Standard Oil Co. (N. J.), has been named by President Eisenhower as a consultant to the National Security Council. Under the reorganization of the Council, seven prominent citizens from different parts of the country and representing different lines of business and educational activity are designated as advisors.

Orbit Valve Opens Casper Warehouse

Announcement has been made by Orbit Valve Co. of the opening of a new warehouse at 1740 East Yellowstone Street, Casper, Wyoming. Jack H. Hancock, Rocky Mountain field representative for Orbit Valve Co., will be in charge. The new warehouse will serve the entire Rocky Mountain region as well as the Western Canadian oil fields.

Forms New Company

Vickers Petroleum Co., Inc., has formed Vickers Explorations Ltd., a partnership operation originated for the purpose of drilling and producing oil and gas properties in Texas, New Mexico, Oklahoma and Kansas.

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Power Distribution Practices

A visual program which outlines the latest electric power distribution practices for industrial plants has been announced by the General Electric Co. The new program presents 12 ideas to help industrial plants maintain power continuity, reduce installation and operating costs, safeguard personnel and equipment, and plan modern, efficient, flexible power systems.

The latest in the G-E "More Power to America" series of presentations, it consists of a 35-mm sound-color slidefilm, a 28-page power distribution manual, and allied literature with additional product information.

The new MPA program is designed primarily for management and engineering personnel of industry. Individual showings of "The Vital Link" can be arranged through electric utility companies or any General Electric apparatus office. The entire package, including slidefilm, sound recording, idea book, and allied publications, can be purchased outright from G.E. for $25.

Oil Industry Producing Sulfur Above Own Needs

The petroleum industry, one of the largest industrial consumers of sulfur, produced an estimated 20,000 tons more sulfur in 1952 than it used in its own operations and is expected to produce surpluses amounting to over 100,000 tons in 1953 and over 200,000 tons in 1954, according to estimates of the Petroleum Administration for Defense.

With sulfur until recently in short supply, the petroleum industry in the past few years has taken steps to increase recovery of the mineral from natural gas and from refinery gases as well as to conserve it through economies in use, Deputy Petroleum Administrator J. Ed Warren pointed out. As a result, with the encouragement of PAD, the industry has been able to shift rapidly from its position as a net consumer of sulfur to a net producer, Mr. Warren said.

Since the defense mobilization program was undertaken in 1950, twelve petroleum-industry projects for recovering sulfur from natural gas or from refinery gases have been completed; 13 such projects are nearing completion and at least three additional projects are planned for future construction, according to PAD figures.

Certificates of accelerated tax amortization have been approved for all of these projects, Mr. Warren said. The certificates permit rapid amortization of from 70 to 85 percent of the cost of individual projects.

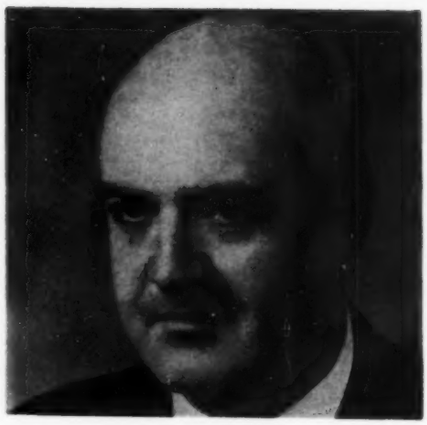
Sulfur output from extraction plants in oil and gas fields and in refineries is expected to more than double between 1951 and 1954. As against 1951 output of 230,000 tons, sulfur production within the industry is estimated at 290,000 tons in 1952, 390,000 tons in 1953 and 500,000 tons in 1954.

Sulfur is principally used in the petroleum industry in the form of sulfuric acid for refining oil products. Gross sulfur requirements for fresh acid in 1951, the last year for which complete figures are available, amounted to 585,000 tons. Net requirements, however, totaled only 235,000 tons.

The difference of 350,000 tons between gross and net requirements is accounted for by (1) sulfur recovered by acid manufacturers from spent acids and acid sludges returned to them by refineries, and (2) the sulfur equivalent of sulfuric acid sold by refineries to fertilizer and chemicals manufacturers for re-use in place of new acids.

The overall sulfur balance in the petroleum industry, on the basis of PAD estimates, is shown in the following tabulation.

	PRODUCTION			REQUIREMENTS (Figures in Tons)			SURPLUS
	Existing Plant	New Plants	Total	Acid	Other	Total	
1951	227,000	3,000	230,000	235,000	22,000	257,000	—27,000
1952	230,000	60,000	290,000	245,000	25,000	270,000	20,000
1953	230,000	160,000	390,000	255,000	27,000	282,000	108,000
1954	230,000	270,000	500,000	260,000	30,000	290,000	210,000



R. H. C. Harrison
President, Canadian Petroleum Assn.

Canadian Petroleum Association

The Canadian Petroleum Association recently has expanded its activities to include all oil operations in the Dominion. In December of 1952, a new constitution was adopted providing a general board of governors to deal with matters of national and general interest, as well as separate boards of directors in the Alberta and Saskatchewan division which will concern themselves with matters of provincial and local interest. Provision is also made for the inclusion of additional divisions as warranted.

The association and its predecessors has expanded continuously during the past 25 years, during which Canadian crude production has grown from 894 to 169,000 b/d.

The Alberta Oil Operators Association, organized in 1927, formed the basis for today's association. In 1929, as crude production at Turner Valley increased and optimism in Canada's oil future grew, this association was reorganized into the Oil and Gas Association of Alberta in order that all branches of the oil industry might be benefited by the active operation of the association.

The Petroleum Producers' Association, formed in 1937 by independent oil producers investigating the marketing situation at Turner Valley, consolidated with the Oil and Gas Association to form the Alberta Petroleum Association in May of 1938.

This association worked in close co-operation with the Canadian Government during the war years, and by providing a representative organization of members of the oil industry, was able to present the viewpoint of this industry to governing bodies.

In August 1947, the association's name was changed to Western Canada Petroleum Association, and during the following years it expanded the area and scope of its activities and services. Standing committees, composed of personnel from the association's membership, were set up to deal with problems encountered in the various branches of the industry. These committees deal with such subjects as accounting, drilling, public relations, reserves, safety and workmen's compensation, taxation, and geophysical operations.

There is a paid administrative staff composed of the president, his assistant, and a statistician, a secretary-treasurer for both the Alberta and Saskatchewan division, and a stenographic section.

Members of the Canadian Petroleum Association produce or refine over 97 percent of Canada's crude production.

Studies Gas Distribution

C. Stribling Snodgrass, internationally known engineer with great experience in the utilization and transmission of natural gas, is in Karachi to prepare a report for Pakistan Petroleum Ltd. on the question of the distribution of gas from Sui in Baluchistan to other parts of the country, with special reference to bringing it to Karachi via Skkur, Rohri and Hyderabad. Pakistan Petroleum Ltd. will make his report available to the Government of Pakistan.

Pakistan Petroleum Ltd. recently completed a second gas well at Sui.

During World War II Mr. Snodgrass was a director of the Foreign Division of the U. S. Petroleum Administration for War and went on many overseas missions, among these being the U. S. Technical Mission (Degolyer Mission) to the Middle East. He has served as consultant to the Brazilian Government on fuel problems and advisor to the Saudi Arab Government on its development program.

Elected United Geophysical Vice President

L. A. Martin was recently elected vice president and chief geophysicist of United Geophysical Co. Mr. Martin has been with United since 1946 and has served as manager in Venezuela and manager of foreign operations. He was with the Shell organization for six years, much of which time was spent on foreign assignments.

American Independent Finds Oil

Advices from the Middle East under date of March 24 contained information that American Independent Oil Company had brought in a producing well on its concession in the "Neutral Zone" between Kuwait and Saudi Arabia. The discovery well, located after five dry holes had been drilled, is reported to have shown on drill stem test a potential flow of 2,400 barrels per day of 31 gravity crude from 3,500 feet.

Oliver Joins Radio Geophysical

Robert M. Oliver has joined Radio Geophysical Company as technical director. He previously was a seismologist with Magnolia Petroleum Co., Dallas. He will be located in Austin, Texas, and will surpervise Radio Geophysical's Radiol crews, carry on research in the theory and application of geo-electric methods of subsurface exploration, and will supervise the company's seismic consultation service.

Named IPAA Information Director

Lyman L. Bryan has been named director of information in the Washington, D. C., office of the Independent Petroleum Association of America. He had been in public relations work with the Pan American Refining Corp., Texas City, Texas, and more recently with the National Cotton Council, Memphis, Tenn.

Joins Warren-Bradshaw

Herman E. Nichols, Jr., has joined Warren-Bradshaw Exploration Co. as exploration manager, and Robert N. Stroud has been named Oklahoma district geologist. Mr. Nichols formerly was with Gulf Oil Corp. and later with Howell, Holloway and Howell, Dallas. Mr. Stroud was with Kirkpatrick Oil Co., Oklahoma City.

On South American Tour

Walter A. Dunn, traveling representative for R. S. Stokvis & Sons, Inc., New York, is on a two-month business trip to South America to call on oil and geophysical company personnel. Mr. Dunn served 12 years with Creole Petroleum Co. and Mene Grande Oil Co. in Venezuela. He will visit Peru, Ecuador, Colombia, Venezuela and Trinidad.

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Argentinian Refinery 75 Percent Complete

Work has reached the 75 percent completion point on a 28,300 b/d catalytic refinery in the Argentine, it is revealed by The M. W. Kellogg Co. The new plant is being erected for Yacimientos Petroliferos Fiscales at Eva Peron (formerly La Plata), and will be called the Presidente Peron Refinery.

Constructed by Y.P.F. under the supervision of Kellogg Pan American Corp., the refinery will include a fluid catalytic cracking unit, alkylation, and one of the world's largest delayed coking units. In addition, there will be two crude units, one of 21,000 b/d capacity, and the other charging 7,300 b/d. Other major processing equipment being erected comprises thermal cracking, straight-run gasoline fractionation, vacuum distillation, and catalytic polymerization.

Electrical Information Digest

Westinghouse Electric Corp., Pittsburgh, has published a folder listing its current booklets dealing with electric equipment for the petroleum industry. Fourteen booklets and three reprints are offered in addition to a file of buying data folders dealing with motors, line starters, circuit breakers, panelboards, switchgear, power transformers, unit substations and gear units. The "Petroleum Industry Information Digest" is available on application.

Magcobar Promotions

New promotions at the Malvern mine and mill of Magnet Cove Barium Corp. have been announced by John Tobler, general superintendent. Men promoted include Elmer Coston, named mill superintendent; Dan W. Martin, chief mine engineer; Richard J. Menze, chief metallurgist; and Joe L. Cheatham, metallurgist. Mr. Coston was construction and maintenance foreman at the mill before his promotion.

International guests of the Los Angeles Chapter of Nomads at its March dinner meeting were: left to right, standing, Felipe de Osma of Sullana, Ltd., Peru; John O. Donovan, Gulf Oil Co., Sicily; Donald Chase, Mene Grande Oil Co., Venezuela; Ken Wetherell, Shell Caribbean, Venezuela; Haroldo Ramos de Silva of Conselho Nacional do Petroleo, Brazil; Arthur S. Bolles, Aramco, Saudi Arabia; and Wally E. Gilbert, B.P.M., The Hague. Seated, Oreila Lima dos Santos of Conselho Nacional do Petroleo, Brazil; Alfonso Chiriboga, former Inspector General, Petroleum Div., Ecuador; P. M. Bowen, Shell of Colombia; and E. de Sousa Carneiro of Conselho Nacional do Petroleo, Brazil.

Chemical Process Division Formed

The M. W. Kellogg Co. has established a special division devoted exclusively to the process design of plants for the petrochemical and chemical fields. Kellogg will place additional emphasis in its research and development department and continue to acquire rights for new chemical processes which supplement designs already developed by the company. Charles C. King, who has been associated with Kellogg's process department for 14 years, is in charge of the new division. L. J. Kelly, who has been a senior project manager, has been placed in charge of the newly-established refinery process division. Both will function under Paul F. Swanson, manager of the process engineering department.

To Build Catformer

Blaw-Knox Company has been selected to design and build a million dollar "cat-forming" plant to produce high octane gasoline for the United Refining Company at Warren, Penn. The new plant, which will use the Atlantic Refining Company's catalytic reforming process, will have a capacity of 2,500 barrels per day of blending stock. Completion is planned for 1953.

One of the leading industrial refiners operating in the Pennsylvania field, United has specialized in the production of high quality lubricating oils for more than fifty years. With the new catformer the company plans to raise its gasoline production to 3,500 barrels per day—double its present output.

HF Detector Developed

A new method of identifying and continuously measuring hydrogen fluoride gas has been developed at Stanford Research Institute. The new device can detect and measure parts-per-billion of HF gas in the atmosphere. As described in the current issue of SRI's news bulletin, "Research for Industry," detection is made on a roll of filter paper impregnated with a fluorescent metal salt. Contact with the slightest trace of HF gas diminishes the fluoresence.

Surveys in Sicily Completed

Geological and gravity surveys in Sicily have been completed by the D'Arcy Exploration Co., prospecting subsidiary of Anglo-Iranian Oil Company. A seismic survey was finished in mid-March. Since June 1951, when Anglo-Iranian was granted permits to search for and produce oil around Ravanusa, Vittoria and Priolo in southern and eastern Sicily, intensive exploratory work has been carried out. There are numerous signs of oil above ground in Sicily, but no producing wells.

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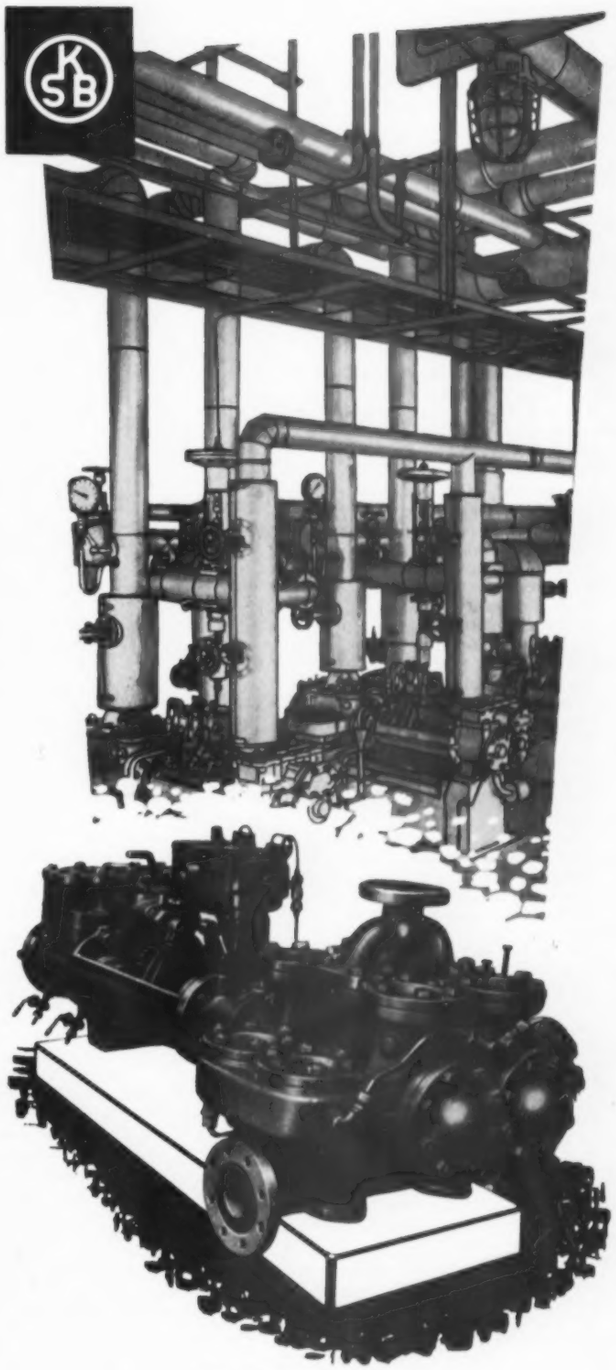

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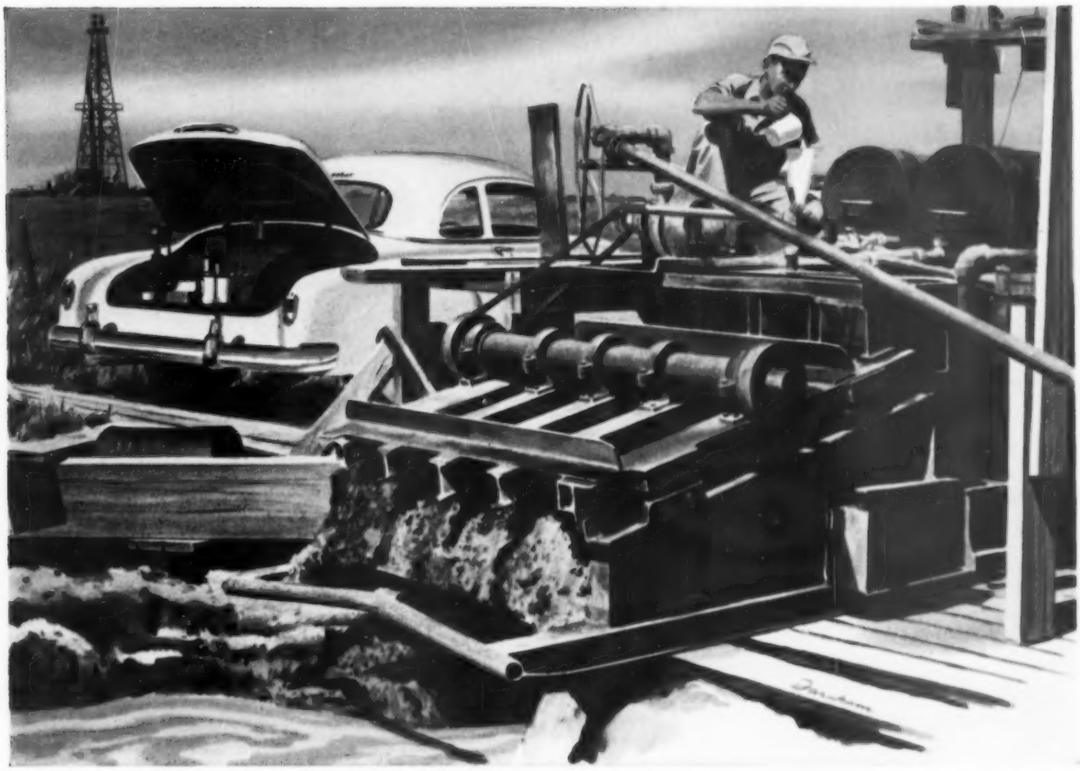

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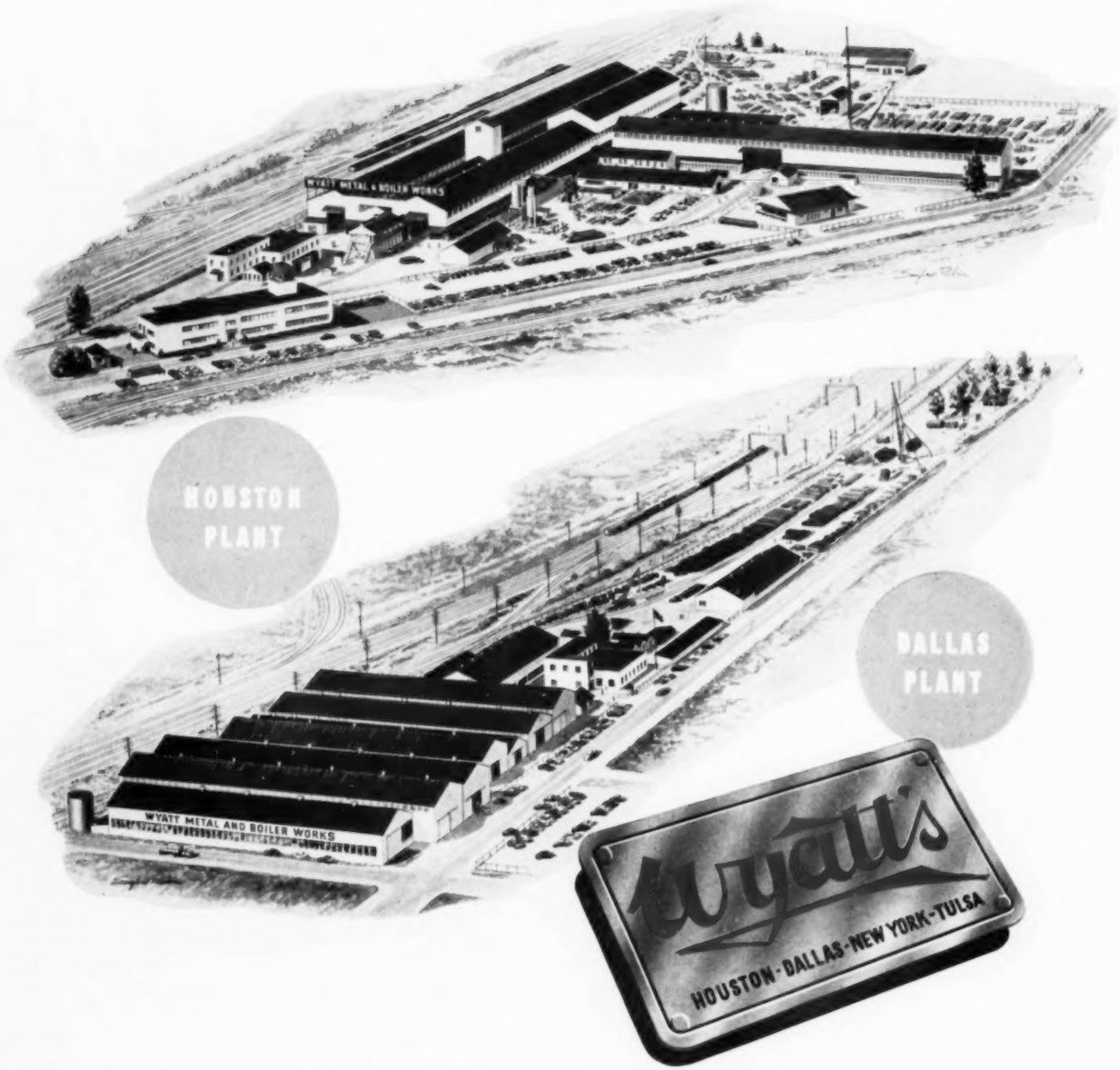

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